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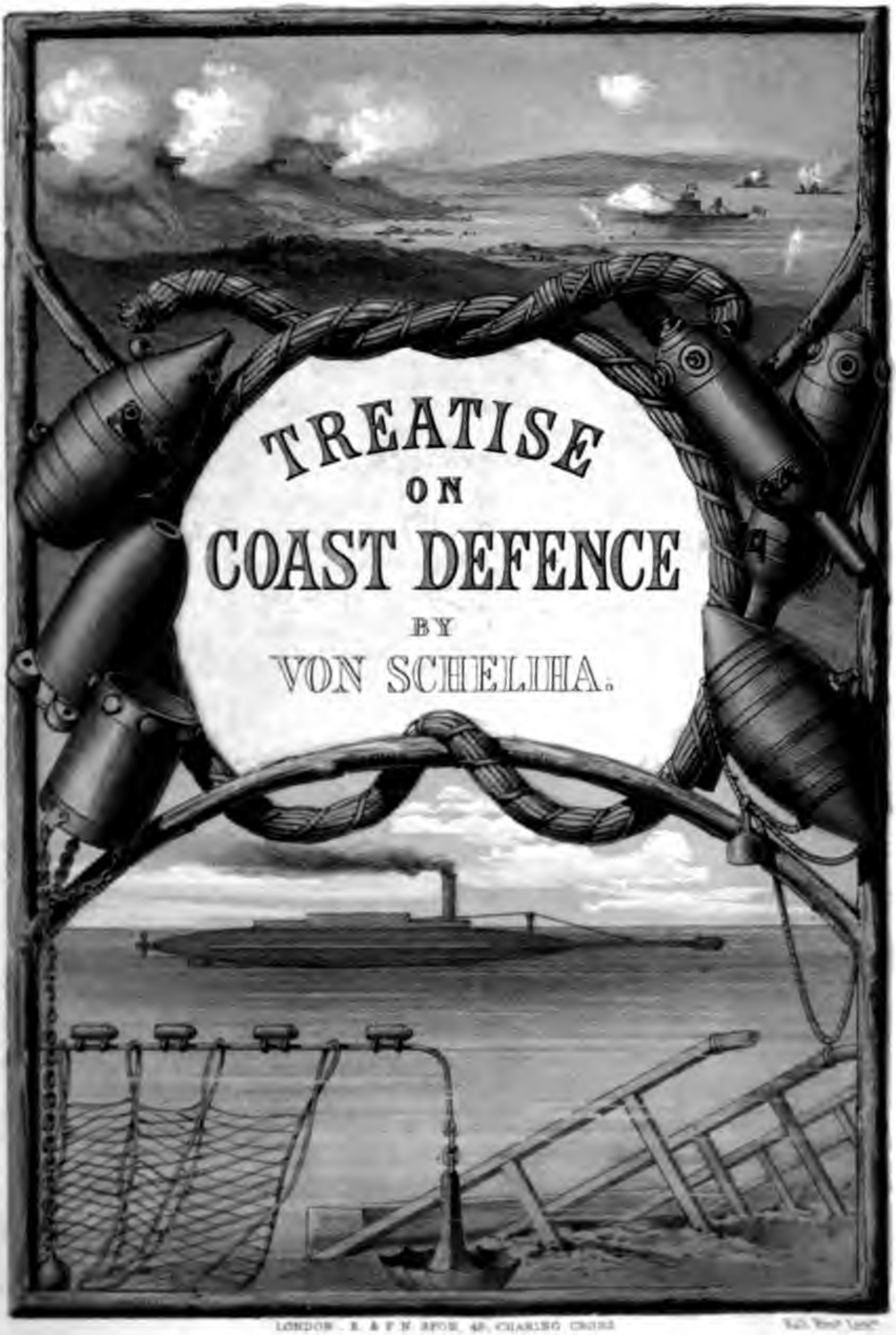

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A TREATISE

ON

COAST-DEFENCE:

BASED

ON THE EXPERIENCE GAINED BY OFFICERS OF THE CORPS OF ENGINEERS
OF THE ARMY OF THE CONFEDERATE STATES, AND COMPILED FROM
OFFICIAL REPORTS OF OFFICERS OF THE NAVY OF THE UNITED
STATES, MADE DURING THE LATE NORTH AMERICAN WAR
FROM 1861 TO 1865.

BY

VON SCHELIHA,

LIEUTENANT-COLONEL AND CHIEF ENGINEER OF THE DEPARTMENT OF THE GULF OF MEXICO
OF THE ARMY OF THE LATE CONFEDERATE STATES OF AMERICA.

LONDON:
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1868.

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TO

ADMIRAL HIS ROYAL HIGHNESS PRINCE ADALBERT OF PRUSSIA

This Treatise

(BY PERMISSION)

IS MOST RESPECTFULLY DEDICATED

BY

HIS VERY HUMBLE AND OBEDIENT SERVANT,

THE AUTHOR.

PREFACE.

THE following treatise presents chiefly the results of the Author's experience and observation in Coast-defence during the four years of the late war in North America. His purpose has been to develop and establish theory from fact. He has endeavoured throughout to support his assertions by extracts from the official reports of officers of the United States' Navy, his late adversaries. Especial attention is called to these extracts, which embody much that is valuable in Coast-defence of the present day.

The work is mainly intended to set forth the principles of Coast-defence as they had developed themselves at the close of the American war, and for the maturing of which we must look to future investigations and experiments by engineers and naval officers.

Obstructions and Torpedoes may be regarded as a comparatively new field. The systems herein described are not offered as perfect, but only as having been tried with more or less success, and as suggesting principles of construction.

The last Chapter gives only a few hints in respect to the lighting-up of Channels and Water-approaches, without pretending to any completeness in this very extensive subject.

The Author takes pleasure in expressing his thanks to those gentlemen who have so kindly assisted him in collecting and arranging the material for the treatise,—to Mr. C. H. Toy,

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INTRODUCTION.

FOR the past thirty years, especially since the annexation of Texas to the United States of North America, the two sections of the republic, the North and the South, had stood in a position of antagonism, resulting partly from difference of social institutions, and partly from difference of economic interests. This antagonism, developed by the contact of the representatives of opposed industrial and social systems in the national legislature, embittered by the efforts of each side to secure the mastery over the other, fed by acts of Congress and by popular expression of opinion, finally appeared in the definite form of political parties, which assumed, more and more, sectional characters. That of the South represented the conservative, agricultural—that of the North the radical, manufacturing—element. A severance of the Union, and resort to arms, was a culmination, foreseen, perhaps, by a few individuals here and there, but unsuspected by the mass of the people, and no preparation for war was thought of on either side. In the election of 1860, however, the issue was made absolutely sectional. A candidate for the presidency was nominated by the republicans, a party sworn to overthrow the state-sovereignty of the South. On the election of this candidate the state of South Carolina, followed by several of the cotton states, seceded from the Union, and the threat of the United States to use coercion for the maintenance of the Union had, as mediate consequences, the secession of all the rest of the slave states (the two border states, Kentucky and Maryland, excepted), the formation of the Confederate Government, and the declaration of war.

As an almost exclusively agricultural region, the South had left to the North the manufacture not only of arms, powder, shot, and, in general, implements of war, but also of the necessary accessories: railroad iron, locomotives, cars, waggons, steam-boilers and engines, telegraph-wire, carpenters' and entrenching tools, spikes and nails, chains and cordages, harness and saddles, cotton and woollen fabrics, shoes, agricultural implements, chemical preparations and drugs; in fine, of all the things absolutely necessary for the maintenance of an independent warfare. For this reason, the South was still wanting in manufacturing establishments of all kinds when the first gun fired at Fort Sumter, in Charleston Harbour, gave, on the 12th of April, 1861, the signal for the commencement of hostilities in good earnest.

Necessity, the mother of invention, taught the Confederates—who, by a strict blockade of all their ports, were soon to find themselves isolated from the balance of the world—to develop the rich, heretofore hardly imagined, resources of their land. Foundries, powder-mills, and other establishments for the manufacture of implements and equipments of war sprang up as if by magic; but here another difficulty was encountered in the fact that the tide of immigration had hitherto turned almost entirely to the Eastern, Middle, and Western States, the inducement of higher wages offered by certain Southern capitalists being, in the opinion of the immigrants, more than counterbalanced by the greatly exaggerated danger of climatic diseases. The South thus found herself, in a great measure, deprived of skilful and experienced mechanics, a want that made itself sorely felt during the whole war, as the full capacity of the fine works at Richmond, Savannah, Augusta, Selma, and Mobile, from scarcity of workmen, could at no time be taken advantage of. By the fall of New Orleans, in the earlier part of the war, an even greater want of foundrymen, and especially ship-carpenters, was created in the Confederacy.

Notwithstanding the immense extent of the United States' territory, its army had, from the absence of any powerful neighbours, and from the jealousy of standing armies felt in republics, been limited to a minimum. Up to 1861, the regular army consisted of only ten regiments of infantry, five regiments of cavalry, four regiments of artillery, and the corps of engineers, making in all an aggregate of about 14,000 men. These, with the exception of the corps of engineers, whose officers were engaged in topographical surveys and in superintending the erection of public structures, were chiefly employed for the protection of settlements along the Indian frontier. The infantry was armed with Springfield muskets; the cavalry used as fire-arms Colt's revolvers, carbines, and rifles; the field-artillery had the old 6-pounder and 12-pounder smooth-bore, mountain 12-pounder, and 24-pounder howitzers. The navy used, as pieces of the heaviest calibre, 10-inch and 8-inch columbiads, but also 42-pounders, 32-pounders (of five different weights), 24-pounders, and even 12-pounders, besides their carronades and howitzers. In coast-defence, for the armament of the few existing fortifications, or for the formation of a siege-train, the 8-inch sea-coast howitzer and mortars were also used, the heaviest of which were 13 and 15 inches diameter. No rifled pieces had been introduced as yet in either the army or the navy.

For time of war the Government relied on the volunteer organizations that existed in every State of the Union, and which, especially since the Mexican War, during which they had rendered most excellent services, had gained a great reputation for their bravery and usefulness in the field. So soon as the ordinance of secession of a State had been passed, these volunteers, by order of their governor, seized all arsenals, navy-yards, and fortifications that had been established or built by the Federal Government within the boundary of the State. The arms and military stores thus taken possession of enabled the seceded States immediately to place an army in the field, which was destined soon to give the enemy a first check at Big Bethel and Bull Run (Manassas). The proportions assumed by the war, already in the second year of its duration, were, however, so gigantic that the number of arms and quantities of war-stores seized in the arsenals at Harper's Ferry, Baton Rouge, Nashville, and other places, no longer sufficed for the needs of the army. Powder and ammunition in general would soon have given out, had the stores not been continually replenished from the works that in the meantime had been established at Richmond, Augusta, Atlanta, and Selma. But the arms themselves, with the exception of several thousand Springfield muskets, were very soon found wanting in the excellences possessed by the rifles and improved pieces of ordnance of an enemy to whom not only the fully-developed resources of his own land, but also those of the whole world had remained open.

Thus, not only was the South at the outbreak of hostilities without the arms, war-stores, and manufacturing establishments necessary for carrying on a struggle of such length as the North American War was destined to reach, but, moreover, she found herself without a single man-of-war, and without sufficient defences for her navigable streams and for a sea-coast that extends from Chesapeak Bay to the mouth of the Rio Grande. Forts St. Philip and Jackson on the Mississippi River below New Orleans, Fort Pike on the Rigolets, Forts Morgan and Gaines at the entrance of Mobile Bay, Fort Pulaski on the Savannah, and Forts Sumter, Moultrie, Johnson, and Castle Pinkney in Charleston Harbour were the fortifications seized from the Federal Government. They had been built at a period when the 8-inch columbiad was yet the heaviest piece of ordnance in use. Neither their location, nor the plan according to which they had been built, could in all instances be considered free from fundamental errors. The science of military engineering, at least as far as coast-defence was concerned, seemed to have come to a stand-still, and received a new impulse only after the brilliant success of the Federal fleet under their gallant and daring commander Farragut had proved the absolute necessity for the military engineer to cast aside many time-honoured ideas, and to raise himself to the point reached already by the naval architect and artillerist. The two navy-yards which the Federal Government possessed at Pensacola, in Florida, and at Norfolk, in Virginia, had also fallen into the hands of the authorities of those States. Much valuable material was taken from them, yet not in sufficient quantity to meet the wants that were to develop themselves during the progress of the war. Even after these wants had become fully known, and after experience had pointed out the surest way of meeting them, the Southern engineer lacked only too often the material and labour for carrying out the plan which he had conceived for the defence of the seaport entrusted to his care.

In regard to sea-coast defence, two things resulted then from this combination of unfavourable circumstances in the condition of the South: Southern engineers were compelled, in the first place, to recognize the inefficiency of the existing modes of defence, and to draw on their scientific knowledge and their ingenuity for new ones; and, secondly, the shifts to which they were reduced originated new combinations and improved methods, which in some cases proved to be of the highest value.

It is the object of the following treatise to present certain principles and methods which during the late war, by reason of the circumstances briefly above detailed, were thus evolved in the coast-defence of the South.

The correctness of these principles having been established by actual experience only, gained during a protracted and severe struggle against the then, probably, most powerful war-navy of the world, a safe basis is offered to the scientific engineer for his difficult task of developing fully methods that, in many instances originating with Southern engineers, could, for want of skilled labour, material, and time during the turmoil of war, not be brought to maturity.

PART I.

> *" You have, first on the Mississippi, and recently in the Bay of Mobile, demonstrated what had been previously doubted—the ability of naval vessels, properly manned and commanded, to set at defiance the best-constructed and most heavily-armed fortifications."*
>
> LETTER OF SEPT. 5TH, 1864, FROM HON. GIDEON WELLES, SECRETARY OF THE UNITED STATES' NAVY, TO REAR-ADMIRAL D. G. FARRAGUT.

THE PROGRESS MADE IN NAVAL ARCHITECTURE AND IN ARTILLERY NECESSITATES A MODIFICATION OF THE PRINCIPLES HERETOFORE OBSERVED IN COAST-DEFENCE.

TREATISE

ON

COAST-DEFENCE.

CHAPTER I.

COAST-DEFENCE has for its object not only the prevention of an enemy from gaining, with assistance of his navy, a foothold on shore, from destroying by the fire of his ships important depôts, arsenals, navy-yards, &c., and from opening a road to the interior of the country by forcing the passage to and taking possession of navigable water-ways; but also the holding of points suitable for a basis for offensive and defensive operations of the national navy, or for a port for blockade-runners and vessels in distress.

It would be a financial impossibility to fortify all points that might be accessible to an enemy along a long-stretched sea-shore; but granting even that the exchequer of a country should justify the erection of strong works for the protection of points of but secondary importance, a most fatal mistake would be made in the attempt to occupy and to hold all these points at one and the same time. A scattering of forces and a weak and unsuccessful defence of each single point would be the consequences.

The Confederates, unwilling to yield to their enemy a single square inch of ground without obstinately contesting it, fell into the error of making an attempt, not only to hold too many points along their sea-coast, but also along their navigable streams. There were Forts St. Philip and Jackson, at the mouth of the Mississippi; Fort Pike, on the Rigolets, between Lakes Pontchartrain and Borgne; the long extended lines around New Orleans; Forts Morgan and Gaines, near Mobile; the batteries near Pensacola; Fort Clinch, near Fernandina; Forts Pulaski, Jackson, and McAllister, and batteries for the protection of Savannah; batteries at Port Royal, Hilton Head, and Beaufort; the works near Charleston, Forts Sumter, Moultrie, Johnston, Castle Pinkney, with batteries on Sullivan's, Morris, and James Islands; the batteries on the Santee, near Georgetown; the fortifications around and near Wilmington, on the Cape Fear River, near Newbern, on the Neuse River; the batteries on Tar River and Pamlico Sound; on Roanoke Island, Albemarle Sound, and the Roanoke River; near Norfolk and at Sewell's Point; on the James River; Fort Henry, on the Tennessee; Fort Donelson and Nashville, on the Cumberland; Columbus, New Madrid, Island No. 10, Fort Pillow, Memphis, Vicksburg, Ports Gibson and Hudson, on the Mississippi; the batteries on the Yazoo River, on Red and White Rivers; the works at Brashear City, near Sabine Pass, Galveston, and Indianola, and many others, besides numerous inland fortifications, that, like those round Bowling Green, in Kentucky; Yorktown, Richmond, Petersburg, and Centreville, in Virginia; Cumberland Gap, in East Tennessee, required a considerable armament and strong garrisons.

Naturally enough this faulty disposition of forces could remain without any serious consequences for the Confederacy only until the enemy opened his vigorous campaigns by land simultaneously with naval operations against the important points on the extended coast and navigable streams.

As early as in 1862 the Confederates lost by direct attack or by evacuation, necessitated by strategic movements of the enemy, the following points: Fort Henry, on the Tennessee River; Fort Donelson, Clarksville, and Nashville, on the Cumberland; Arkansas Post, Columbus, Island No. 10, Memphis, Forts Jackson, St. Philip, and New Orleans, on the Mississippi

River; Fort Pike, on the Rigolets, between Lakes Borgne and Pontchartrain; Pensacola, Jackson, Fort Clinch, and Fernandina, on the coast of Florida; Hilton Head, Beaufort, Newbern, and the coast on the Pamlico and Albemarle Sound; Norfolk, Suffolk, and the coast of Chesapeake Bay, with Sewell's Point.

The garrisons, guns, ordnance-stores and provisions lost, as well as the labour, material, and time expended in fortifying places, that, with a few exceptions, kept the enemy at bay only so long as he was not fully prepared for his attack, or were evacuated even before a real attack was made, would have been from the first better employed had they been concentrated at fewer points, rendering these doubly and trebly strong against attacks not only by water, but also by land.

These losses were soon followed by the fall of Plymouth, of Vicksburg, Port Hudson, and the whole of the Mississippi River, so that, towards the close of the year 1864, Charleston, Wilmington, Savannah, Mobile, and Galveston were the only ports remaining in the hands of the Confederates. However much such losses dimmed the prospects of the Southern cause, one good resulted from them—the scattering of forces, ordnance and ordnance-stores, and of material, and labour ceased, and the few remaining points on the sea-shore could be placed in a state of defence that would have defied all efforts of the enemy's navy, had the superior strength of his army not gained successes for him that necessitated the evacuation of these places also.

It is not intended here to draw a comparison between the newly created and rapidly exhausted resources of the Southern Confederacy in war, and those of older countries in peace; yet, the above statements clearly show, that under all circumstances the plan of selecting for sites for fortifications only as many points as are absolutely necessary for the establishment of a well-secured basis in coast-defence, will prove the one that offers most chances for success.

A perfect system of coast-defence must necessarily combine two elements: a local defence, based on the efficiency of batteries afloat and ashore, on obstructions and torpedoes; and, if the seeming contradiction may be allowed, secondly, on offensive defence, or the series of active operations which must be left to the conjoined efforts of the army and navy.

The success of local defence supposes: fortifications, that will withstand the fire of modern artillery; batteries, able to affect the armour of iron-clads, such as will hereafter be used in attacks on fortified points; and obstructions sufficiently strong to prevent the enemy's steamers from passing out of reach of these batteries without leaving them time for continuing their fire at close ranges. The success of an offensive defence, next to the strength and efficiency of the army and navy, will depend on the facilities that exist for the concentration of a sufficient force with which to hinder the enemy from establishing a lodgment at any given point on the coast, or should he have succeeded in effecting a landing, to oppose any further invasion.

A navy so powerful as to be able to keep the enemy blockaded in his ports and prevent him from leaving his own shore, would naturally enough be the most efficient means of defence any country could create for her coast. But as such a project in most cases would present another financial impossibility, more feasible plans, better adapted to the means of each individual government, must be devised. Among them the building of strong iron-clad floating steam-batteries, and the construction of railroads, radiating, with their branches and telegraph lines, to different points on the sea-shore, recommend themselves as cheaper methods even than the erection of extended and costly permanent fortifications at points that, in themselves of no vital importance, do not contain navy-yards, arsenals, depôts, &c., and which could be protected by forces stationed at suitable distances near the junction of railroad lines, and held in readiness for any case of emergency.

Flying columns, detached from these forces in the direction of the coast, and seconded by the vigilance of the inhabitants of the districts threatened with an invasion, would observe the enemy and occupy him after a landing till assistance could arrive from the main force. A vigilantly performed out-post service—whereby fishermen, pilots, and other inhabitants intimately acquainted with the hydrography of all approaches to existing landing-places, and the topography of the surrounding country, will be able to render most valuable assistance—must lead to better results than the plan of studding the coast with fortifications that all require garrisons, and thus necessitate a scattering of forces.

During the North American war, Confederate ships have but seldom had opportunity to act on the offensive with any reasonable prospect of success. The South having to create her little war-navy with means but little adequate to the purpose, her ships, although gallantly fought in every engagement they participated in, were neither numerous nor powerful enough to cope with the superior fleet of the United States. By means of the railroads, traversing the territory of the Confederacy in all directions, it might have been feasible to convey considerable forces to places being besieged or being threatened with a serious attack. But the invading columns advanced from so many directions and in such strength, that the decimated forces of the South were no longer able to cover all threatened points. An attempt made by General Jos. E. Johnston to relieve General Pemberton's command, attacked by General Grant at Vicksburg, failed as early as in 1863; Fort Fisher and the works on Federal Point, near Wilmington, were not defended by a garrison strong enough to hold the position against the combined attacks of the enemy's navy under Rear-Admiral David D. Porter, and the army under General Terry. General Sherman's march from Atlanta to the Atlantic coast necessitated the evacuation of Charleston and of Savannah; and the last of the Confederate strongholds on the coast of the Gulf of Mexico, Mobile, had a garrison of hardly 6000 men, instead of the 12,000 which the position absolutely required, and after a short but gallant defence this place too was evacuated.

A concentration of forces with the object to relieve a threatened sea-port, could be effected in but few instances during the whole course of the war, and then only so long a time before the real attack was made, that the reinforcements were again called away to meet more pressing emergencies, that meanwhile had arisen at another point, as in the cases of Charleston, Wilmington, Savannah, and Mobile; or after the propitious moment had passed, for possibly relieving the attacked point, as in the case of Vicksburg. At no time was it possible to spare from the army in the field reinforcements for a fortified position on the coast at the moment they were most needed there.

For such reasons the defence of the southern coast remained essentially limited to local defence.

PRINCIPLES DEVELOPED IN LOCAL COAST-DEFENCE DURING THE NORTH AMERICAN WAR.

CHAPTER II.

The success of any defence is dependent on the proportion of the forces and means of which the attacked party may dispose, and the skill with which these are employed, to the forces, means, and manner of attack of the enemy.

The progress made in naval architecture and in artillery since 1861 has necessitated a thorough change of the principles observed and methods employed heretofore in coast defence. Fortifications that might have resisted any attack of sailing vessels carrying 8-inch, and even 10-inch columbiads, can no longer withstand the artillery fire of modern iron-clads.

I.—*Exposed Masonry is incapable of withstanding the Fire of Modern Artillery.*

The truth of this assertion will be sufficiently established by the following instances:—

1. *Fort Sumter* was situated in Charleston Harbour, on an island at equal distances from Morris and Sullivan's Islands. The work had the trace of a pentagon, was built in strong masonry, and arranged for two tiers of casemated guns, and a third tier of guns mounted *en barbette*. Only vessels of light draught can effect a passage between the fort and Morris Island. The main channel, commanded by the work, lies to the north, and has a width of about 1700 yards. The gorge of the fort faced to the south.

After the ordinance of secession of the State of South Carolina had been passed, the State authorities at once seized the fortifications protecting Charleston Harbour, with the exception of Fort Sumter, which was being held by Major Anderson, of the United States' Army. A surrender having been refused, the newly-established Confederate batteries opened upon the fort on April 12th, 1861. Without causing the loss of a single life, the bombardment rendered the place soon untenable, at least for the time being: the barracks having been set on fire, the artillerymen were by the smoke prevented from working their guns, and the flames threatening to reach the badly protected powder-magazines, Major Anderson capitulated on April 13th.

With the fort the following pieces were surrendered to the Confederates: six 24-pounders, forty-one 32-pounders, ten 42-pounders, eight 8-inch sea-coast howitzers, ten 8-inch and three 10-inch columbiads, making in all 78 guns. The masonry of the work, the barracks excepted, had not suffered materially from the bombardment. The southern engineers proceeded at once to the building of heavy sand-bag traverses, to the securing of the much-exposed magazines, and to the strengthening of the gorge, and of those faces liable to suffer, *en revers*, from the frontal fire of the enemy, directed against other faces. All combustible material was removed from the terreplein of the fort, and the guns of light calibre were at the earliest practicable moment changed for 10-inch columbiads and 7-inch Brooks' guns. At the same time all approaches by water to the city of Charleston were obstructed as far as existing means would allow, and new batteries were established at eligible points.

A first attempt to force a passage by Fort Sumter failed.

Admiral Dupont had engaged the fort with his iron-clads on April 7th, 1863; a heavy artillery duel ensued, lasting about 40 minutes, and resulting in the withdrawal of the fleet, with the loss of one vessel.

Only the barbette-guns of the fort had somewhat suffered from the enemy's fire; the damage done to the masonry was yet comparatively trifling, and the capacity of the place as a defensive work had been rather heightened by the cheerful spirit that animated the garrison after this successful engagement. The weak points of the fort had also become more clearly defined to the engineers, who with great energy continued to strengthen the place by building traverses, protecting the exposed gorge with sand-bags, and arranging suitable bomb-proofs.

Perceiving that his navy alone would not succeed in reducing Fort Sumter, the enemy proceeded now to the establishment of breach-batteries on land. Siege-operations against Battery Wagner had already been commenced, but they were interrupted for a while to attack Fort Sumter more vigorously. On August 16th, 1863, the following batteries had been established:—

		Armament.	Distance from Fort Sumter.
a. In rear of the 1st parallel opened against Battery Wagner	1. Navy Battery ..	2 8-inch Parrot guns 2 80-pounder Whitworth guns ..	3980 yds.
b. In rear of the 2nd parallel opened against Battery Wagner	2. Battery Brown ..	2 8-inch Parrot guns	3516 „
	3. „ Rosecrans	2 6·4 „ „	3447 „
	4. „ Meade ..	2 6·4 „ „	3428 „
c. Left batteries, south-west of the 1st parallel ..	5. „ Hays ..	1 8 „ „	4172 „
	6. „ Reno ..	1 8 „ „ 2 6·4 „ „	4272 „
	7. „ Stevens ..	2 6·4 „ „	4278 „
	8. „ Strong ..	1 10 „ „	4290 „

These, in conjunction with Battery Kirby (formerly O'Rourke, mounting two 10-inch mortars), and the Monitors opened on Fort Sumter on August 17th, continuing the bombardment till August 23rd, for seven days.

Sumter was a ruin, and had but one serviceable gun left.

The batteries had expended 5009 projectiles, of which number about one-half had hit the fort. Remarkable is the effect of the bombardment on the gorge, and the two faces that could be taken *en revers*.

The garrison, nothing daunted by the fiery ordeal they had passed through, with double ardour commenced the clearing of rubbish to gain positions for new guns, made the bomb-proofs more secure, and tried by every means to render the ruin as tenable as possible. In this work they were interrupted by another bombardment that was opened by all batteries on the fort on August 30th, and continued for three days.

No vestige of a heavy gun remained in the fort. Battery Wagner having been evacuated by the Confederates on the night of September 7th, the moment appeared propitious for executing a *coup-de-main* against Fort Sumter. Admiral Dahlgren ordered a boat-attack, but how signally this failed may be seen from the following:—

(*a*.) REPORT OF LIEUTENANT-COMMANDER E. P. WILLIAMS.

"ROXBURY, MASS., Sept. 27th, 1864.

"SIR,—I have the honour to make the following report of the capture of myself and party on the morning of the 9th of September, 1863, in an attempt to storm Fort Sumter:— .

"On the morning of the 8th I received orders from Admiral Dahlgren to take command of a division of boats in a night attack on Fort Sumter; to proceed with the vessel under my command outside the bar, and call for the requisite number of men and boats from the vessels stationed there. During the day I collected the men and boats; the number and names of which have been reported by their respective commanders. I re-crossed the bar after sunset, so late as to render it impossible for the enemy to see the boats in tow. On reporting on board the flag-ship, I found the remainder of the force assembled around that vessel, but the order of attack had not been arranged. Lieutenant Preston and myself at once arranged the different divisions; Commander Stevens, who commanded the party, approving of the arrangement and of the orders. The landing party was in three divisions.

"First division, commanded by myself.

"Second division, commanded by Lieutenant Remey.

"Third division, commanded by Lieutenant Preston.

"The orders were to form the divisions as soon as cast off from the tug, pull quietly for the fort, land without firing, and do our best to gain the walls; the other divisions, with the marines, to cover or land, as circumstances should require. Commander Stevens fully approved of these orders.

"At nine o'clock I saw Commander Stevens, and received his last orders. I said to him that the orders were fully understood: if he should not be up to land with me, I would land as soon as I reached the fort; if the enemy should offer no resistance to the landing, would form my men, wait for him, and all go over together; but if resistance was made, I would storm the walls at once, and depended upon being supported. He said he expected to land with me; and if not, would see that the others supported my division. That is the last order I received from him. Between ten and eleven o'clock, the tug got under way, and, with the boats in tow, we steamed up the harbour. After nearing the fort, it turned back, and three times it made a circle near the fort. None of us in the boats could understand the manœuvre, and it had the effect of damping the ardour of the men. Suddenly, without any word being passed to prepare for it, we found the boats adrift, the tug at the same time heading, so as to render it impossible to form the divisions without great confusion. Ordering the first division to follow me, I pulled clear of the boats, and formed line abreast. The first division was composed of the following boats:—

"*Powhatan* third cutter, Acting-Master Hustace and Lieutenant Pope, of the Marine corps, with fifteen marines.

"*Powhatan* fourth cutter, with myself, Acting-Master's Mate Hovey and Sail-maker Wm. Brayton.

"Gig from the *New Ironsides*, Ensign Porter.

"*Wissahickon* first cutter, Acting-Master Dayton.

"*Wissahickon* second cutter, Acting-Master's Mate King.

"As I was to land in the gorge wall, I took the right of my division, ordered Mr. Porter on the left, to make sure the boats should be kept close. As soon as the division was formed, I ordered the boats to lie on their oars, and only use them to keep our position. The tide swept us rapidly up to the fort: when within fifty yards, the sentinel on the gorge-wall hailed. I made no reply, but with my night-glass sought a good place to land. He hailed three times, and fired on us at the third hail, to which I answered, 'Passing.' On his firing, having found a good landing-place, I ordered the boats to give way and land. Three strokes of the oars sent us to the beach. I at once jumped from my boat, followed by the men, and started up the walls. On reaching the top of the second tier of casemates, we found the top of the wall projected, so as to render it impossible for us to close with the enemy. Mr. Porter, who was on the left of the division, and most distant from the beach, was by my side almost as soon as I struck the beach. Mr. Dayton, in the *Wissahickon* third cutter, also landed at once with his men; but of those in the third cutter of the *Powhatan*, in charge of Acting-Master Hustace and Lieutenant Pope, only two landed, William Simms, boatswain's mate, and Corporal Cully, marines. They reported that when they left the boat Mr. Hustace was giving the order to shove off, and they jumped from the boat to follow the landing-party. I know no reason why all in the third cutter should not have landed at once. They could have landed with a small loss, and retreating only exposed them to a heavy fire. I saw nothing of the *Wissahickon's* second cutter, under the charge of Acting-Master's Mate King. He must have retreated at the first fire. I know no reason why the officers of these two boats should not have landed at once, and followed me, as they were ordered. Lieutenant Remey, commanding the second division, landed; only a part of his division followed him. Lieutenant Preston, commanding third division, also landed, but was not followed by the others of his division. The boats that held back opened fire with their revolvers, the shot striking among us, who were half-way up the walls.

Hoping to find a place where we could close with the enemy, I ordered the boats outside to cease firing, and land, repeating the order several times. Lieutenants Meade and Bradford, of the Marine corps, at once ceased firing, and landed, losing but a few men, which shows how easy it would have been for the other boats to land. At this time the forts on James and Sullivan's Islands opened fire with shell; also a ram with grape and canister. It was then impossible for my boat to pass through the fire. The enemy sunk or disabled all the boats by shots and bricks thrown from the wall. Finding it impossible to get over the walls, I ordered the men to shelter themselves in the holes made by our shells. The enemy kept up a constant fire on us, throwing hand-grenades, bricks, fire-balls, and other missiles among us. Hoping something might be done for our relief, I would not surrender; but some of the men from Lieutenant Bradford's boat, he having been mortally wounded in landing, surrendered, and were ordered around on the left to come into the fort. I stopped these, and ordered them under the walls. Soon finding it was only losing my men, without gaining anything, on a consultation with the officers, I surrendered, and was shown inside the fort, where we were courteously treated by Major Elliott, commanding the fort. The following officers were captured:—

"First Division.—Lieutenant-Commander E. P. Williams, Ensign B. H. Porter, Acting-Ensign E. G. Dayton, Acting-Master's Mate C. P. Hovey, Sail-maker W. S. T. Brayton, severely wounded.

"Second Division.—Lieutenant J. C. Remey and Acting-Master's Mate C. S. M'Carty.

"Third Division.—Lieutenant S. W. Preston, Lieutenant E. T. Brower, and Third Assistant-Engineer J. W. Harmony.

"Fifth Division.—Lieutenants of Marines R. L. Meade and C. H. Bradford, the latter mortally wounded.

"Ninety-five seamen and marines were also captured, and loss in killed and wounded amounted to three killed and twenty wounded, the names of which I will forward to the Department as soon as I can receive them from Columbia.

"The wounded were well treated by the enemy. All the officers and men who landed behaved gallantly, and only surrendered when there was no hope of a relief, and it was found to be impossible to close with the enemy.

"I would request that Lieutenants Remey and Preston may make a report of the conduct of the officers of the boats of their divisions. I know of no reason why they should not have followed their commanding officers. The small loss sustained in the boats which landed shows how easy it would have been for all to land. They could not tell but that those who landed were engaged hand to hand with the enemy, for, with good glasses and time enough to have a fair look at the walls, I fully expected that we would be able to go over them.

"The conduct of all since our capture has been good, with the exception of William Hill, seaman from the *Powhatan*, and William Beeby, officer's steward from the *Housatonic*, who were bribed by the enemy, and deserted, giving all the information in their power regarding the squadron off Charleston. They took the oath of allegiance, and are now in the Southern Confederacy.

"I have the honour to be, very respectfully, your obedient servant,

"E. P. WILLIAMS,
"Lieutenant Commanding U.S. Navy.

"HON. GIDEON WELLES,
"Secretary of the Navy."

On the evacuation of Morris Island by the Confederate forces, during the night of the 6th to the 7th of September, Batteries Wagner and Gregg had fallen into the hands of the enemy, who at once thoroughly repaired these works, and established in them also heavy batteries. Great exposure to the musketry of Fort Sumter being apprehended by the commander of the Federal navy for the boats, which he intended to assign to the dangerous service of removing the channel obstructions between Forts Sumter and Moultrie, preparations for another bombardment were made, by which it was hoped to render the ruin so untenable as to drive the garrison out of it. The bombardment was opened on October 26th by Batteries Gregg and Wagner, and again continued for several successive days, the Monitors participating in it. The fire being mainly directed at the gorge and south-east face of the work, practicable breaches, reaching to the level of the water, were soon effected. The following extract from the report of Rear-Admiral J. A. Dahlgren in regard to this bombardment will serve to give an idea of the effect it produced on the fort:—

(*b.*) REPORT OF REAR-ADMIRAL J. A. DAHLGREN.

"FLAG-STEAMER *Philadelphia*, OFF MORRIS ISLAND,
"SOUTH CAROLINA, Nov. 4th, 1863.

"SIR,— * * * * * *

* * * * * * * * *

"The army, having sufficiently advanced with the re-fortification of Morris Island, opened fire on Fort Sumter October 26th, the object being to complete its reduction by driving out the garrison, and occupying it. The firing has been prosecuted steadily since, and I have examined the progress daily by going up the channel, where a near view could be obtained of the works.

"I directed the *Patapsco* and *Lehigh*, being armed with rifle-guns, to take position also at effective range, but not exposed to that of Moultrie and its adjacent batteries.

"The line of fire from Putnam passed directly through the north-west and south-east angles of Sumter, therefore looked equally on the gorge and south-east front.

"The fire from the Monitors was nearly perpendicular to the south-east front, and looked acutely on the north-east front. At first the fire ashore seemed aimed at the gorge, which had been originally faced for two-thirds of its height with sand-bags. Upon these the fragments of the top of the wall had lodged, and formed one mass of sand and crumbled brick, where the rifle-shells entered to no great depth.

"The fire of the Monitors was directed at the south-east face, and appeared to exhibit a more marked action there, because the *débris* had fallen down into deeper water, and not lodged to the same extent as on the gorge.

"The fire of Putnam and Strong were soon after applied to the south-east front, which gradually gave way to the united fire, until it, too, was reduced to a slope of fragments, much lower, however, than that of the gorge.

"By the end of the week the opposite walls of the fort were cut and jagged by the shells, which passed over the main front, and the north-east face looked very dilapidated.

"On Sunday I had a conversation with General Gillmore on the state of affairs, and on Monday went up with him and General Seymour to view Sumter from Fort Strong; after which we had a conversation in General Seymour's tent, on the best possible course to be pursued. General Gillmore finally concluded for the present to continue the fire on Sumter.

"The fire of the Monitors has been generally very good, and on many occasions excellent.

"Captain Stevens reports that of 455 shells fired in seven days, 315 took effect on or in the fort.

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"Captain Stevens states:—'The explosion of the fifteen-inch shells fired with 5″ and 20″ fuzes in the inside of the fort, which gun was fired occasionally, produces an effect which is hardly describable, throwing the bricks and mortar, gun-carriages, and timber in every direction, and high into the air.'

"I find that the effect of these shells is also noticed by the commanding general ashore.

"Last evening I examined the appearance of the fort (as I have done every day), and could plainly observe the further effects of the firing. Still this mass of ruin is capable of harbouring a number of the enemy, who may retain their hold until expelled by the bayonet, which, in the proper order of things, will devolve on our comrades on shore.

* * * * * * *

"I have the honour to be, very respectfully, your obedient servant,

"JOHN A. DAHLGREN,
"Rear-Admiral Commanding S.A.B. Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington, D.C."

From the foregoing facts it will be seen that the capacity of Fort Sumter as a defensive work had actually ceased with the bombardment closed on August 23rd, 1863. The fort was a mass of ruin, the heavy fire of the enemy prevented the mounting of new guns, and only a few serviceable field-pieces remained. Even these had to be sheltered in bomb-proofs during the day, and were brought out only towards night, to be used in case a boat-attack should be made by the enemy.

That the fort was held so long was only due to the pertinacious and unyielding courage of its brave garrison, and to the ingenious and practical skill of the engineers in charge, who all were rivals in carrying out to the very letter the directions given them by General Beauregard and his talented chief engineer, the lamented Col. Harris.

2. *Fort Morgan* is situated on Mobile Point, the extreme western end of a narrow and low strip of land projecting from the eastern shore of Mobile Bay for several miles in an almost due westerly direction. The fort, a brick structure, was built in 1833. Its object is the protection of the entrance to Mobile Bay from the Gulf of Mexico. Although the main ship-channel passes between Mobile Point and the eastern bank (a shoal changing in width and depth, and extending in a southerly direction for over a mile, commencing about 4000 feet from Fort Morgan), the United States' engineers had entirely neglected this most eligible point for a fortification, and had preferred to establish, in 1857, another permanent work, Fort

Gaines, on the extreme eastern end of Big Dauphine Island, 3½ miles west of Mobile Point. The distance is too great for the works to second each other.

Fort Morgan has six faces, forming nearly a regular hexagon. The flank defence of its wide and deep ditch is effected by guns mounted in casemated bastions, but with the exception of these, all guns were mounted *en barbette*. A high octagonal brick citadel, with an inner yard, stood at a distance of twenty feet from the casemated main rampart. It served as a barrack to the garrison, and had been intended as a reduit. For revetment, even for that of the inner slope of the parapet of the batteries on the main rampart, masonry alone had been used. The sally-port of the work is laid through the northern face. Want of labour had prevented the engineers from carrying out certain plans, that, based on the experience gained at Forts St. Philip, Jackson, and Sumter, would have placed Fort Morgan in a better state of defence. They succeeded, however, in completing a glacis of sand around the whole work, in establishing two batteries on the covered way, and another at the foot of the glacis of the western face, in erecting heavy sand-bag traverses for the protection against enfilading fire and fire in reverse, also in protecting the well-filled powder and provision magazines against vertical fire.

What effect a shot from the 100-pounder Parrot gun would produce on the masonry was clearly proved on July 4th, 1864, by a few shots fired at the fort from one of the blockaders at a distance of over 3000 yards: a shot glancing over the covered way struck the scarp wall one foot above the sole of the ditch, penetrated the wall, opening a hole fully two feet in diameter, and had force enough left to injure very considerably the inner wall of the casemate. Three other shots fired on that day from the same vessel produced a similar effect. The prospect for a successful defence of the place, consequently, could be anything but cheerful after Admiral Farragut had, on the 5th of August, forced his entrance into the Bay of Mobile.

Fort Gaines having capitulated on the 8th of August, the Federal land forces operating under General Gordon Granger, against this work, were transferred to Mobile Point, where they commenced at once regular siege operations against Fort Morgan. Under the protection of the sand mounds that are formed here by the action of the wind, they had been able to carry their trenches to within a very short distance of the fort. The breach batteries, among them a four-nine-inch-gun Navy-battery, opened at daylight of August 22nd. Admiral D. G. Farragut says in his report, dated Flag-ship *Hartford*, Mobile Bay, August 23rd, 1864:—

"At daylight of the 22nd, the bombardment began from the shore batteries, the Monitors and ships inside the bay and outside, and a more magnificent fire I think has rarely been kept up for twenty-four hours.

"At half-past eight P.M. the citadel took fire, and the General ordered the near batteries to redouble their fire. At six this morning an explosion took place in the fort, and at half-past six the white flag was displayed on the fort."

The effect of this bombardment presents in one respect some analogy to that of the first bombardment of Fort Sumter by the Confederates; in either case the artillerymen were prevented from continuing to work their guns by the flames and smoke that shot forth from the burning barracks. In Morgan's case, however, the difficulty was increased to an impossibility, not by the heavier and nearer artillery-fire of the enemy alone, but also by the accurate fire of his sharpshooters, who had effected a lodgment on the very crown of the glacis itself.

General Richard L. Page, the commanding officer at Fort Morgan, was compelled to destroy most of his ordnance-stores, for which he had no longer any magazine secure against the enemy's shells; he was not even able to find within the whole fort, every face of which was being taken in reverse, a safe shelter for his provisions, large quantities of which had been burnt with the citadel; and under such circumstances he wrote the following letter:—

"FORT MORGAN, Aug. 23th, 1864.

"GENTLEMEN,—The further sacrifice of life being unnecessary, my sick and wounded suffering and exposed, humanity demands that I ask for terms of capitulation.

"Very respectfully, &c.,
"R. L. PAGE,
"Brigadier-General C.S.A.

"REAR-ADMIRAL D. G. FARRAGUT, U.S.N.,
"MAJOR-GENERAL GORDON GRANGER, U.S.A.,
"Commanding, &c. &c."

A bombardment of another twenty-four hours would have changed the place into a shapeless pile of rubbish. The terms of the capitulation having been agreed upon, the fort was surrendered at two o'clock on the evening of August 23rd, 1864. With it 136 guns, most of them unserviceable, and a garrison of 587 men, were surrendered to the Federal commanders.

3. *Forts St. Philip and Jackson* are built on the banks of the Mississippi, which river they were intended to bar against an enemy approaching New Orleans, the metropolis of the South, from the Gulf of Mexico. Both forts are casemated brick structures.

Admiral Farragut boldly conceived the plan to run by these forts, give battle to the Confederate flotilla stationed here, and force New Orleans to surrender. His attack was prepared by a bombardment of both forts, especially of Fort Jackson, from the mortar flotilla commanded by Rear-Admiral (then Commander) David D. Porter. The several divisions of this flotilla having been placed at ranges varying from 2850 to 3680 yards from Fort Jackson, and at even greater distances from Fort St. Philip, they opened their fire on April 16th, 1862. Previous to assigning to the mortar-schooners their places, Commander Porter had directed the masts of the vessels to be dressed off with bushes, by which arrangement they were made invisible to the garrison of the forts, and intermingled with the thick forest of trees and matted vines behind which they were placed. At five o'clock in the evening of the same day Fort Jackson was in flames, the citadel having been fired by the enemy's bomb-shells. Most of the clothing and commissary-stores were burnt up. The bombardment was continued with the assistance of several of Admiral Farragut's large ships. On the 23rd the most efficient gun in Fort St. Philip, a heavy rifle-piece, was dismounted by a mortar-shell (this is one of the very few instances that occurred during the war of a piece having been dismounted by vertical fire), and the mortar flotilla, that up to this moment comparatively had suffered but little from the fire of the forts, was now even less annoyed by it.

In regard to the effect of this bombardment on Fort Jackson the following will be found interesting:—

"South-west Pass, Mississippi River,
"May 4th, 1862.

"Sir,—While engaged in the survey of the injuries received by Fort Jackson during the bombardment and the passage of the fleet, several incidents came under my notice, which, at your request, I have now the honour to submit to you in writing. While waiting for the boat to take us off, on the last day on which we were engaged in the survey, Mr. Oltmanns and I fell into conversation with some men who had been in the fort as part of the garrison. One of them, who said he was a New-Yorker, particularly informed us—a reliable, intelligent man, from the moderation of his statements—and I think his information well worthy of note.

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"General I. K. Duncan had command of both forts, and Colonel E. Higgins, who some years ago was an officer of the United States' navy, had the immediate command of Fort Jackson. Colonel Higgins has the credit of being a most brave and vigilant officer. For forty-eight hours my informant thought Colonel Higgins had not left the ramparts, and never seemed in the least disconcerted when the bombs were falling thickest around him. A large proportion of the forces inside the fort were northern men, and there were also many foreigners. The party that seized the fort early in 1861 was a company of German Yagers, and there were a number of Irish also. In all there were some 600 or 700 men in the fort at the time of the bombardment. The northern men were mostly sent down at an early stage of the proceedings, and I imagine most of them volunteered, hoping in that way to avoid suspicion, and perhaps not to have to fight against the government after all.

"Colonel Higgins had no expectation of being attacked; that is, he thought no fleet could be brought against him sufficiently strong to risk an attack. There was a company of sharpshooters attached to the forces, under the command of Captain Mullen. They numbered about 200, and were largely recruited from the 'riffraff' of New Orleans. They scouted as far down as eight or nine miles below the forts, and brought nightly reports to Fort Jackson, travelling by the bayous and passes on the south-west side of the river. The main body, however, lay in the edge of the woods below Fort Jackson, about a mile and a half from it. From here they fired on the boat that pulled up under that shore on the 14th. The grape and canister shot that the *Owasco* threw into the bushes made their berth uncomfortable, and they broke up their camp, came into the fort all wet and draggled, having thrown many of their arms away, and swore that they would go to New Orleans; and they went.

"My informant voluntarily gave the credit of reducing the fort to the 'bomb fleet.' The fort was so much shaken by this firing that it was feared the casemates would come down about their ears. The loss of life by the bombs was not great, as they could see them coming plainly, and get out of the way; but the effect of their fall and explosion no skill could avert. About one shell in twenty failed to explode; even those that fell in the water going off as well as the others. It is well worth noting that the bombs that fell in the ditch close to the walls of the fort, and exploded there, shook the fort much more severely than any of those that buried themselves in the solid ground.

"The firing was most destructive the first day, and the vessels lying on the north-east side of the river, which were in plain view of the forts, made much the most effective shots. The bomb-vessels lying on the other side of the river were at at all times totally invisible, the best glasses failing to distinguish their bush-tops from the trees around them. During the bombardment the only guns that were much used were the rifled guns, of which there were three, and the four 10-inch columbiads, and Dahlgren 8-inch guns, eight in number. The mortars (in the fort) fired occasionally. One of the rifled guns, mounted on the fort proper before the bombardment, was sent, two days before the fire opened, to Fort Pillow.

"One of the rifles in the water-battery was originally one of the barbette guns, a 32-pounder. It was sent to New Orleans to be rifled, and a week after the second one was sent; but the first, on trial, proving a failure, the second one was not changed.

"The large columbiad in the water-battery was made somewhere in Secessia, but exactly where my informant did not know.*

"The fort was in perfect order when the bombardment commenced, it having always been strictly policed, and the dirt, which now disfigures everything, is the accumulation of a few days.

"The water did not enter the fort until the levee had been broken with bombs; and during the summer of 1861, when the Mississippi was even higher, the parade-ground was entirely

* It came from the Tredegar Works at Richmond, Va.

dry. There was very little sickness in the fort, the water probably not having stood long enough to create miasma.

"The discipline in the fort was very strict; but what seemed to be felt more than the strictness was the bringing in of very young and inexperienced officers, who were placed in command of others much their superiors in knowledge.*

"Suspected men were closely watched, and the punishment for improper talk among them was to tie a rope around the offenders, and let them float in the stinking ditch.†

"The impression we derived from this part of the conversation, however, was that the fort was very well governed, and that the man who was speaking had not often come under the displeasure of the authorities, for he was not eloquent on the subject of his wrongs.

"The chain, as first stretched across the river, was quite a formidable obstacle. The chain was brought from Pensacola, and was a very heavy one. It was supported by heavy logs, thirty feet long, only a few feet apart, to the under-side of each of which the chain was pinned near the up-stream end. The chain was kept from sagging down too far by seven heavy anchors, from which small chains run to the main chain.

"These anchors were buoyed with can-buoys taken from Pilot Town. In a few months, a raft formed on the upper side of this chain, which reached up to the forts, and its weight swept away the whole obstruction, and went to sea, carrying the buoys with it.

"It was then replaced by the lighter chain, buoyed by hulks there, three weeks ago. Two of the large can-buoys were placed in the magazine in the water battery. The night that Flag-Officer Farragut's fleet passed up, Colonel Higgins was so sure of destroying it that he allowed the first vessel to come up with the fort before opening fire, fearing that they would be driven back prematurely, and escape him. When they succeeded in passing, he remarked, 'Our cake is all dough; we may as well give it up.'

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* The first regiment of Louisiana artillery was often called the first Louisiana regulars, because here, as in the regular army, no election of officers was allowed; they were appointed by the President.

† Gross exaggeration.

" The small loss of life in the fort is due, to a great extent, to the fact that the men have been carefully kept below, only the guns' crews being allowed out of shelter. The New-Yorker was a powder-passer for the battery in which the rifled gun and the large columbiads of the main fort were, and, therefore, had a good opportunity of seeing what was going on, they being in pretty constant use.

" One bomb broke into the officers' mess-room while they were at dinner.

" On the first night of the firing, when the citadel and outhouses were all in flames, the magazine was in very great danger for some time, and a profuse supply of wet blankets was all that saved it. There was great consternation that night, but afterwards the garrison got used to it, and were very cool.

" Fort Jackson mounted thirty-two 32-pounders on main parapet, two columbiads on main parapet, one rifle gun on main parapet; two columbiads in second bastion; two 8-inch mortars in third bastion; eight 32-pounders in north-west casemates; six 32-pounders in north-east casemates; ten howitzers in bastion casemates; two brass field-pieces; two rifled guns in water-battery; one 10-inch columbiad in water-battery; one 9-inch columbiad in water-battery; three 32-pounder guns on outer curtain—seventy-five guns in all.

" Of these guns four were dismounted, but I could not see that the gun proper was injured in any case; of the gun-carriages eleven were struck, several of them being entirely destroyed; and of the traverses no less than thirty were injured. A large portion of the last injured were on the western side of the outer curtain (where only these guns were mounted), twenty out of thirty-nine being more or less injured.

"The ramparts of the fort proper were very severely damaged on every side, but particularly on the two northern ones; there has been great patching with sand-bags needed; several of the entrances from the parade-ground under the ramparts are masses of ruins, some of them being one-third chocked up with *débris.*

"The casemates are cracked from end to end; one of the bastion casemates has the roof broken through in three places; another in one place, and its walls are so badly cracked that daylight shines through very plainly, the cracks being about four inches wide.

"The entrances to the casemates are nearly all damaged, the roofs cracked, and masses of brick thrown down or loosened. All the buildings were destroyed by fire or bomb-shells, the two western bastions and the citadel being completely burned out. The walls of the citadel are cracked in many places very badly.

"Eighty-six shot and splinters of shell struck its faces. The amount of damage here reported would hardly be credited by any one who had taken a casual survey of the premises, and I myself should have considered it exaggerated if I had read it after passing through hastily the first time. After careful examination, however, the impression left on my mind is of a place far gone on the road to ruin, which will stand but little more before it will come down about its defenders' ears. Everything about the fort appears to have started from its place, some hardly perceptible, others so much that it would be hard to find where the proper place is. It looks to me as if the whole structure would have to be demolished and rebuilt, if the Government ever intend to fortify the site again.

* * * * * * *

"Very respectfully,
"Your obedient servant,
"JOSEPH HARRIS.

"F. H. GERDES, ESQ.,
"Assistant United States' Coast Survey."

The small loss of life to the garrison from this bombardment is a most remarkable feature. The destruction went beyond all description. The ground was torn by the shells as if (to use the expression of another eye-witness) "a thousand antediluvian hogs had rooted it up;" the craters were from three to eight feet deep, and very close together, sometimes within a couple of feet; all that was wood in the fort was completely consumed by fire; the brick-work was knocked down; the arches stove; guns were dismounted; gun-carriages broken, and the whole presented a dreadful scene of destruction. New Orleans having been evacuated by General Mansfield Lowel, the commander of the Confederate forces, Admiral Farragut found no further resistance after he had passed the Chalmette Batteries. All communications of the forts with the interior was now cut off, and on April 28th, 1862, they were surrendered to Admiral David D. Porter, who from his mortar flotilla had bombarded them for 144 consecutive hours.

4. *Fort Pulaski* is another of the number of permanent works, that having been seized by the Southerners, and placed in state of defence by their engineers, was destined to succumb to the fire of Federal artillery. The fort is built on the bank of the Savannah River, and was considered a work strong enough successfully to defend the main water-approach to the city of Savannah.

General Hunter, the commander of the Federal land-forces, opened on the fort with his breaching batteries on the 10th of April, 1862. At two o'clock in the evening of the following day Fort Pulaski surrendered.

The bombardment had begun at eight o'clock A.M. on the 10th, and continued during the day; but at first, while procuring the ranges, it was somewhat inaccurate. On the second day, in spite of a high wind, the firing from the rifled guns and columbiads was very destructive to the fort; the former boring into the brick face of the wall like augers, the latter striking like trip-hammers, and breaking off great masses of masonry, which had been cut loose by the rifles.

The four upper batteries were above sixteen hundred yards distant from Pulaski, and quite beyond the distance at which it has hitherto been held practicable to effect a breach, but which proved an easy breaching range to the improved ordnance of the present day. When the fort surrendered, the barbette guns had been silenced, and many of them had been dismounted. The breach was practicable in two places, and could have been stormed without doubt. The enemy's projectiles went through it, and were knocking down the opposite wall which protected the main magazine, so that the garrison was convinced that in an hour or two the magazine must be blown up.

The heavy 13-inch mortars inflicted less injury than was anticipated; the casemates, having been protected by sand-bags, were but little shaken from them.

These instances will suffice for proving the incapacity of masonry to resist the fire of modern artillery.

CHAPTER III.

II.—*Earth, especially Sand-works, properly constructed, a better Protection against Modern Artillery than permanent Fortifications built on the old plan.*

THE best illustration and proof of this principle will be found in the following statement of bombardments, which actually occurred during the North-American war:—

1. *Island No.* 10 is situated in a bend of the Mississippi River, near New Madrid, below Columbus. On the island proper only four batteries, mounting from two to four guns, had been established, while the left bank (Tennessee side) of the river had been lined with eleven batteries, which, extending for the distance of one and a quarter mile, reached from Battery Rucker (No. 1) to Battery No. 11, opposite the head of the island. These batteries could not be considered samples of engineering skill: they consisted of a parapet five feet high, and twenty-two feet thick; had no traverses against the splinters of bursted projectiles, and no service magazines, the budge-barrels standing on the terre-plein, and being protected against the weather by tarpaulins spread over them. The main magazine for all these batteries was hardly proof against heavy shells; the laboratory had been established in an old shanty situated a little to the rear, but still within reach of the enemy's fire; the provisions were kept on a store-boat, and two steamboats, flying the yellow flag, served as hospitals. There were no bomb-proofs for the men, and the infantry forming part of the garrison were repeatedly driven from their encampments, and forced to seek shelter against the enemy's shells by occupying other

camp-grounds in the woods that skirt the rear of the position. Against these batteries the enemy had concentrated a flotilla of six iron-plated gun-boats, one wooden gun-boat, and sixteen mortar-boats, all standing under command of Flag-Officer A. H. Foote, who opened his fire early on the morning of the 16th of March, 1862, and continued with changing vigour—on an average one shell in every ten minutes—till April 7th. On March 17th and April 4th the firing had been quite brisk, yet notwithstanding a bombardment of twenty-three days, the damage done to the batteries amounted almost to nothing: but one single gun had been dismounted.

Two of the enemy's gun-boats, the *Carondelet* and the *Pittsburg*, succeeded in passing the batteries during the nights of April 4th and 8th; all communication with points situated on the river below was thus cut off, and the place fell, not because it had in any way been rendered untenable by the bombardment, but because it was being attacked in the rear by General Pope's whole army.

2. *Vicksburg*, another point on the left bank of the Mississippi River, had, after the fall of Island No. 10, Fort Pillow, Memphis, and New Orleans, obtained much importance, because its batteries now formed the main hindrance to the free navigation of that stream. The position for the batteries had been judiciously selected; the parapets were of sufficient thickness, but were lacking in height, and nothing, or but little, had been done by the engineers towards creating bomb-proof shelters for the garrison of a place destined to be subjected to a series of some of the most fierce bombardments that took place during the course of the war.

Rear-Admiral David D. Porter says, in his report of the 7th of February, 1863:—

"On the morning when the ram *Queen of the West* went by the batteries, I had officers stationed all along to note the places where guns fired from, and they were quite surprised to find them firing from spots where there were no indications whatever of any guns before. The shots came from banks, gulleys, from railroad depôts, from clumps of bushes, and from hill-tops, two hundred feet high. A better system of defence was never devised.

"Vicksburg was by nature the strongest place on the river, but art has made it impregnable against floating batteries—not that the number of guns is formidable, but the rebels have placed them out of our reach, and can shift them from place to place, in case we should happen to annoy them (the most we can do) in their earthworks.

"In a report I made to the Department while attached to the mortar-flotilla, I remarked, 'that the navy could silence the water-batteries whenever it pleased, but that the taking of Vicksburg was an army affair altogether,' and it would have to be taken by troops. At that time it mounted twenty guns, all told, scattered along as they are now, and ten thousand men could have marched right into it without opposition.

* * * * * * *

"The people in Vicksburg are the only ones who have, as yet, hit upon the method of defending themselves against our gun-boats, viz.: not erecting water-batteries, and placing the guns some distance back from the water, where they can throw a plunging shot which none of our iron-clads could stand.

"I mention these facts to show the Department that there is no possible hope of any success against Vicksburg by a gun-boat attack, without an investment in the rear of the city by a large army. We can, perhaps, destroy the city and public buildings, but that brings us no nearer the desired point (the opening of the Mississippi) than we are now, and would likely put out the little spark of Union feeling still existing in Vicksburg."

Rear-Admiral Porter gave in this report to the Secretary of the Navy a fair account of the situation near Vicksburg: he succeeded repeatedly in driving the men from their pieces, and in temporarily silencing the Confederate batteries by a most furious fire concentrated on them from his fleet, yet no injury of any note was done to these earth-works, and Vicksburg only fell after General Grant's large army had invested the place, and for several months had carried on regular siege operations.

3. *Battery Wagner* was a sand-work built on Morris Island, with the view of preventing the enemy here from establishing breaching batteries against Fort Sumter. This battery had been almost constantly exposed to a most severe fire since the time the enemy had commenced operations against Charleston. Not being able to demolish the battery by the concentrated fire from the ships and batteries ashore, and less even to take the work by assault, the Federal commander had been compelled to proceed in regular siege operations against Battery Wagner. In these the Sappers were so much molested by the fire of its eighteen guns, that a general bombardment of the work was ordered for the 5th of September, 1864.

Thirteen heavy pieces, seventeen siege and several Coehorn mortars, assisted by the heavy battery of the *New Ironsides*, opened on Battery Wagner early on the morning of September 5th, and continued their fire without intermission for forty-two hours. The 11-inch smooth-bore guns of the *New Ironsides* fired shells, that, glancing over the parapet, and either bursting immediately over the gun-chambers, or entering the cover of the bomb-proof in their rear, did good execution. Less effective were the shells thrown from the batteries of rifled pieces ashore; they mostly burst in striking, and threw up a mass of sand that fell back into the same place.

This tremendous firing silenced the work in a few hours, the gunners being compelled to seek shelter in the bomb-proof, and the working parties in the trenches were now enabled to advance to the salient and the flank of the eastern bastion, without being any further molested by the fire of the Confederates. The space between a row of palisades and the counterscarp of the ditch could even be filled with fascines and sand, and every preparation for a final assault, to have taken place on the morning of the 7th September, had been completed when the Confederates evacuated the position.

2864 shot and shells had been fired against Battery Wagner during these forty-two hours, the bomb-proof had been hit over 1200 times, the parapet and traverses over 1400 times, and yet but three guns had been totally dismounted, and the bomb-proof remained intact. The embrasures of the sea-face and the banquette alone had been damaged to an extent that would have required more thorough repair.

Thus, Battery Wagner is a striking proof of the little effect produced by artillery-fire on a well-constructed sand-work.

4. *Fort Fisher*, erected since the outbreak of the war, was situated near the extreme end of Federal (Confederate) Point, and was the main work protecting the entrance to Cape Fear River, and the approach by water to Wilmington.

The fort was built of sand, had a heavy profile, and was provided with traverses and a bomb-proof. Its guns were mounted *en barbette*.

On this work Rear-Admiral David D. Porter opened, on the 24th of December, 1864, with the batteries of not less than thirty-three vessels, among them the heavy battery of the *New Ironsides*, holding besides eighteen vessels in reserve.

Previous to making the attack, a boat loaded with many tons of powder had been taken as near to Fort Fisher as possible; the distance reached was about 250 to 300 yards from the beach. Benjamin F. Butler, then a major-general in the Federal army, had suggested this idea in the hope of blowing Fort Fisher to atoms by the explosion of so large a quantity of powder. The infernal machine exploded at forty minutes past one o'clock on the morning of the 24th of December without doing any damage whatever to the fort.

At half-past eleven o'clock on the same morning the bombardment was opened, and continued till four o'clock in the evening, at an average rate of 115 shells per minute. In one hour and fifteen minutes after the first shot had been fired from the ships, the guns of Fort Fisher were temporarily silenced, it being indeed impossible for anything human to stand the torrent of missiles falling into and bursting over the fort. A little after ten o'clock on the morning of the 25th, the bombardment was re-opened and kept up for seven hours, the fort first answering with a slow and deliberate fire. During the day the Federals landed a large force, and at half-past four advanced a line of skirmishers on the left flank of the sand-curtain, the fleet at the same time making a concentrated and tremendous enfilading fire upon the curtain.

The garrison, however, at the proper moment, when the fire slackened to allow the approach of the enemy's land force, drove them off with grape and musketry; at dark the enemy withdrew.

General Benjamin F. Butler, in his letter of the same day to Rear-Admiral David D. Porter, says:—

"Upon landing the troops and making a thorough reconnoissance of Fort Fisher, both General Weitzel and myself are fully of opinion that the place could not be carried by assault, as it was left substantially uninjured as a defensive work by the navy fire. We found seventeen guns protected by traverses, two only of which were dismounted, bearing up the beach and covering a strip of land, the only practicable route, not more than wide enough for a thousand men in line of battle.

* * * * * * *

"Finding that nothing but the operations of a regular siege, which did not come within my instructions, would reduce the fort, and in view of the threatening aspect of the weather—wind rising from the south-east, rendering it impossible to make further landing through the surf—I caused the troops with their prisoners to re-embark, and see nothing further that can be done by the land forces. I shall therefore sail for Hampton Roads as soon as the transport fleet can be got in order.

"My engineers and officers report Fort Fisher to me as substantially uninjured as a defensive work."

* * * * * * *

While the strength of the work had been practically tested, its defects had also become known to the Southern engineers, who were busily at work in repairing damages and carrying out the plans for improvement that had suggested themselves during the bombardment, when the enemy again appeared in even stronger force than the first time.

On the 13th of January, 1865, Rear-Admiral David D. Porter re-opened on Fort Fisher a very rapid and severe fire from forty-four ships, placing the iron-clads, *New Ironsides*, *Saugus*, *Canonicus*, *Mahopac*, and *Monadnock*, within 1000 yards of the fort. The bombardment was kept up during the night by the Monitors and the *New Ironsides*.

On the 14th the general bombardment commenced at one o'clock P.M., and continued till long after dark; on the 15th all vessels had reached position at about eleven o'clock A.M., and each opened fire as they got their anchors down. The fire was kept up furiously all day, yet the Mound Battery of the fort could not be hindered from answering most gallantly.

A strong force, under command of General Terry, had been landed on the 13th, and all arrangements for an assault on Fort Fisher being completed by three o'clock on the evening of the 15th, the assault was made at five o'clock. 1600 sailors and 400 marines had been detailed to accompany the troops– the sailors to board the sea-face, while the troops assaulted the land side. Seeing so large a body of men coming at them on the sea-side, the garrison, under the impression that this was the main attack, concentrated the larger part of their forces against it, and signally repulsed the enemy, but were taken in reverse by the land forces commanded by General Terry.

Notwithstanding a most obstinate defence, retreating fighting from one traverse to another, the brave garrison in all

2300 men—were not able to hold their own against the superior strength of the enemy, and Fort Fisher fell.

During the last bombardment of January 13th, 14th, and 15th, the Federal fleet had fired over 50,000 shells against the fort, and yet the power of resistance of the work was so little broken, that the garrison was still able to repulse the determined and gallant charge made by Admiral Porter's 2000 marines and sailors on the sea-face, and held themselves even for several hours against General Terry, who poured in his superior strength through the badly protected gorge of the fort.

5. *Fort Powell* was built on an oyster-bank between Cedar Point and Little Dauphine Island, for the protection of Grant's Pass, which forms the entrance from Mississippi Sound into the Bay of Mobile. Admiral D. G. Farragut, commanding the Western Gulf Blockading Squadron, appeared before this work in February, 1864, and opened from his mortar and gun-boats a fire on the small fort, that would have battered any brick or stone structure into a mass of ruin. The firing, especially that from the 15-inch mortars, could in accuracy not have been surpassed; one shell after another falling on the earth-cover of the bomb-proof, penetrating as deep as three and a half feet, exploding, and opening a crater of seven feet in diameter. The bombardment was steadily kept up from February 22nd till March 2nd, without making any impression whatever on the fort; not a single gun had been dismounted, not a single traverse had been seriously damaged, nor had the parapet and the bomb-proof lost any of their strength, all damage done by the exploding shells being at once repaired by throwing sand-bags in the opened craters. But one man had been killed, another wounded, and the brave commandant of the fort, Lieutenant-Colonel James M. Williams, of the 21st Alabama Regiment, paid for his temerity in unnecessarily exposing himself to the shower of the enemy's iron missiles with the loss of his coat-tail. The wharf and quarters on the east face of the fort had been considerably damaged by

the bombardment. This face, being the gorge of the work, had not been completed when Admiral Farragut forced his entrance into the Bay of Mobile; an evacuation of Fort Powell being, therefore, the only means to save its garrison from capture, the place was abandoned, after preparations for the blowing-up of the magazine had been so well made, that its explosion took place hardly half an hour after Lieutenant-Colonel Williams, the last man, had left the fort.

CHAPTER IV.

III.—*Guns mounted en barbette, even when protected by properly built Traverses, may be silenced by a Concentrated Fire from Ships.*

To the instances mentioned in the preceding chapter of earth and sand-works not having been substantially injured as defensive works by the effect of some of the most severe bombardments which occurred during the North American War, other examples could easily have been added; yet there are but few instances known in which the Federal fleet did not succeed in silencing, at least temporarily, Confederate batteries, whenever a sufficient number of guns was brought against them to keep up a fire, that, brave and courageous as the artillerymen of the Southern army were, rendered it impossible for them always to stand by their guns.

Batteries Wagner and Gregg, Fort Fisher, the batteries at Grand Gulf and Vicksburg, the water-battery of Fort Morgan —in fine, every battery was, at least temporarily, silenced whenever the enemy brought up a greatly superior number of guns, keeping up a continued and concentrated fire against the battery.

There were certainly instances of vessels being driven back by batteries, the guns of which were mounted *en barbette.* Admiral Dupont's attack on Fort Sumter, in Charleston Harbour, on April 8th, 1863, when nine iron-clads, among them the *New Ironsides,* had to withdraw from the fire of guns mounted *en barbette;* Commander John Rodger's attack on Drewry's Bluff, below Richmond, on May 15th, 1862, when the *Monitor* and the iron-clad frigate *Galena*, with the *Aroostook*, *Port Royal*, and *Nangatuck*, were repulsed by Commodore Ebenezer Farrand's battery of 8-inch and 10-inch columbiads; the attack on a small battery of 32-pounders near Sabine Pass, Texas, whereby the United States' steamers *Clifton* and *Sachem* were lost, September 8th, 1863, will serve as a few of the many instances in which Confederate batteries repulsed an attack of the Federal navy. Yet in not a single one of these attacks had the fire of the ships been kept up as vigorously and long as during the bombardments mentioned in the preceding chapter.

Some of the Southern engineers, desirous of giving to the guns and artillerymen a more efficient protection than is given by mounting guns *en barbette*, constructed casemates of two and even three thicknesses of railroad iron. On trial these casemates were found so dangerous, not being able to resist a 10-inch shot, that they were entirely abandoned, and earth or sand-works built in their place.

As models of such works, the following are given:—

1. *Fort Powell* (see Plate II., figs. 2 and 3) was built on a shell-bank, at high tide partly submerged. The terre-plein had to be raised 3 feet above high tide; and for this reason first a row of cribs (5 feet wide, 10 feet long, and 6 feet high, made of 12-inch pine logs) was placed along the outside line of the basis of the work. For the filling of the space inside this line of cribs, oyster-shells were used till a level with low water outside had been reached. The cribs themselves were filled with sand, and protected by rocks on the outside. An attack from the west (Mississippi Sound) being to be expected first, the western face, first of all, was placed in a state of defence. The parapet was 8 feet high, 25 feet thick, had an interior slope of one-third of its height, fell on the superior crest 2 feet, and had an exterior slope of 1 to 1. On each face of the work three guns were mounted, each standing in its own circular chamber, 18 feet in diameter at

the bottom, and 24 at the top. These chambers were formed by heavy traverses, which being elevated 3 feet over the gun-chamber, and reaching 9–12 feet over the superior crest of the parapet, extended to the bomb-proof, forming part of the parapet of the cavalier. The guns were mounted at a distance of 60 feet from centre to centre of their platform. In order to enable the parapet securely to withstand the effect of a heavy bombardment, it received not only the heavy profile of 25 feet, with an exterior slope of 1 to 1, but also a broad berm. On this berm another parapet, 4 feet 6 inches high, giving protection only against musketry, was built for the double purpose of gaining the greatest possible effective line of infantry-fire against boat attacks, and of giving the work an abundant supply of sand out of which to fill the sand-bags necessary for the repairing of damages sustained by a heavy bombardment. A further judicious use of the large sand-masses required for the construction of this work was made by establishing traverse rifle-pits, and a line of infantry defence on the cavalier, which latter also served as position for two Whitworth guns. The bomb-proof contained the main powder-magazine, a shell and filling-room, a laboratory, a blacksmith-shop, water-tank, surgeon's-room, besides quarters for the men. A covered passage established safe communication between the gun-pits, and each gun had been provided with its own service-magazine. The traverses formed a kind of embrasures for the guns, allowing them a field of about 110°–170°, which could be increased by cutting part of the traverses, or decreased by closing the embrasure with sand-bags. The importance of the steadiness of platforms, and the thorough securing of the pin of the chassis of barbette-carriages having impressed itself on the mind of the chief engineer of the department by his experience (dearly bought at Island No. 10, where of fifty-one guns, thirty-eight had dismounted themselves after the first fire, in consequence of the badly-constructed platforms having settled in the new ground), extraordinary care was bestowed on the laying of a firm foundation for the platforms, and on making them as strong and level as possible. As a foundation served four sills, 12 × 12 inches, and 12 feet long, which were laid parallel to each other, at a distance of 3 feet from centre to centre; on these four other sills of equal size were laid crosswise, with the same distance between them, the upper sills being let into the lower ones, so that the whole formed a level surface, which was 8 feet below the superior crest of the parapet. After the earth had been firmly packed in and around the sill-frame, the first platform, forming an octagon, and consisting of fourteen pieces of sawn timber, 12 × 12 inches, was laid, and secured by bolts to the sill. On this another octagonal platform, consisting of twelve pieces of timber, of the same size (12 × 12 inches), and on this again a third platform, consisting of ten timbers, was securely fastened, the three platforms forming three steps, making it easy for the gun detachments, especially Nos. 1 and 2, to step from their exposed position on the platform to a place giving them the advantage of being protected by the full height of the parapet. The pin rested on a disk of iron, half an inch thick, and was let through the whole of the upper and part of the middle platform; besides, it was secured by the pintle-cross, which consisted of two pieces of timber, 5 feet long, 10 inches wide, and 5 inches thick, securely fastened to the platform by iron bolts. The greatest care was bestowed on laying the traverse-circle level in all its parts. To prevent an accumulation of rain-water on the platform, planks tapering from the pintle-cross to the traverse-circle, and having a slope of one-half of an inch towards the periphery, were laid in addition. Auger-holes bored through these planks and the upper platform timbers, passing under the traverse-circle, formed small drains for water falling on the platform. The whole was saturated with rosin-oil, protecting the timbers against the influence of the weather.

In permanent fortifications foundations of granite or beton, and iron pintle-crosses, will naturally be preferred for platforms; in provisional fortification, however, when the engineer very often lacks time and material for carrying out more complete plans, the platform here described will be found to answer all purposes.

The channel west of Fort Powell had been obstructed by torpedoes and a row of *chevaux-de-frise* made of railroad iron.

2. *Batteries on Choctaw Bluff, on the Alabama River,* 110 *miles above Mobile.* If Fort Powell may serve as a model for a water-battery, as they were towards the close of the war constructed by Southern engineers, the Choctaw Bluff batteries will give an idea of the general plan followed in the construction of batteries, when placed at a certain elevation above the level of the channel which they were intended to defend.

Choctaw Bluff is situated on the right bank of Alabama River, at a distance of eight miles from Owen Bluff, on the left bank of the Tombigbee River, and about fifty miles above the junction of these rivers. Both places had been fortified with the view of closing the navigation of the two rivers in case Mobile should fall into the hands of the enemy.

The highest elevation of the bluff above the mean height of the Alabama river is 91 feet; its slope towards the bend of the river is gradual, whilst its fall towards the river-bank and a boggy bottom, that is situated between the river and a millpond, is very steep. The position was well chosen, the course of the river being such as to expose a boat to a heavy fire not only while approaching and passing the batteries, but also after having passed them.

Two gulleys, running at nearly right angles to the river, facilitated the mounting of two guns five feet above high-water mark. All other guns were placed in gun-chambers sunk into the natural ground, and lying in different vertical and horizontal planes, thus forming terraces *en échelon.* The position was to be protected in the rear by a strong line in bastions. From the parade of the work well-covered communications led into the several gun-chambers, which all stood in communication with each other by a gallery 4 feet wide and 6 feet high. From these galleries a short branch led to the service-magazines established for every gun; the main magazine was built in one of the many gulleys within the enceinte of the place. A heavy parapet, giving perfect protection to riflemen aiming at the portholes of the enemy's vessels, extended from gun-chamber to gun-chamber, serving at the same time as a traverse against any enfilading fire. Provisions were stored in bomb-proof storehouses; there were bomb-proof surgeon-rooms, kitchens, and wells; heavy traverses against enfilading fire or fire *en reverse* had been erected wherever deemed necessary. It would have been almost impossible to dismount any of the guns, except by vertical fire, and then only by a chance shell; in fine, all the experience gained in engineering at Charleston, Savannah, Wilmington, Vicksburg, and other places had been put in requisition for the building of these batteries. And yet in order to silence them the enemy would have been required only to bring sixty or seventy guns to bear on them, keeping up a rapid and concentrated fire.

The calibre and number of guns supposed to be equal, a battery, the guns of which are mounted *en barbette*, may always be silenced by an iron-clad protected by plating of sufficient thickness. But an enemy will always have the advantage of being able to concentrate against any number of guns ashore a larger number of guns on his ships: he may commence an engagement or break it off at his own convenience; may chose his own ranges and positions, and use his shrapnell with terrific effect against so desirable a mark as a gun mounted *en barbette* must be to the naval gunner. Masking the guns of the battery with sand-bags, and retaining the fire till the enemy has approached to within so close a range that the fire must necessarily produce a severe effect on the iron-clad or iron-clads against which it is concentrated, is probably the best way of fighting a barbette-gun battery; yet the battery will, after all, in nine cases out of ten, be silenced by the rapid firing of the superior number of guns brought against it.

Therefore, in order to build a battery able to cope with modern iron-clads it is not only necessary to avoid, in the construction of the battery, all material not able to withstand the effect of a heavy artillery-fire, but it is also absolutely necessary to give to guns and gun-detachments a more efficient protection than is afforded them by mounting the guns *en barbette.*

It is, however, not the object of this treatise to enter into a detailed discussion of, or to decide between, all the features of the various systems of iron-casemated batteries which have been proposed for coast defence during the last few years, and this subject will therefore be dismissed with the following general remarks:—

1. All officers of the navy and of the corps of engineers who, during the American war, had opportunities for gaining practical experience in the attack on, and defence of, positions along the coast, no matter on which side they gained this experience, agree that sand or earth is the cheapest and best material that could be used in the construction of batteries.

2. The reduction of such works, properly constructed and provided with bomb-proofs, when left to the navy alone, required a long time and great expenditure of ammunition.

3. Guns mounted *en barbette* may be silenced by a superior number of guns being brought against them.

4. Therefore, the guns and gun-detachments should be protected by iron casemates, standing behind a sand-parapet, and exposing the least possible surface as an object to the enemy's fire.

5. Whether for these iron-casemated batteries the most perfect system known, that of the revolving monitor-turret, or the simpler mode of covered iron screens, be adopted, a thickness of at least twenty inches at its most exposed points would not appear too great for the armour on which the fire

of a hundred guns and more may be concentrated all at the same time.

6. The front surface of the casemate should at all its points present to the enemy's missiles an angle small enough to render the bolt, ball, or shell liable to glance off.

7. The pivot-point of the gun should be thrown into the embrasure, which should be so small as to be almost closed by the muzzle of the gun.

8. The single batteries should be connected by a strong sand-curtain, which they should enfilade by their fire.

9. All works exposed to an attack from the rear, after the enemy's fleet has passed the batteries, should be closed and heavily armed in the gorge.

10. Wherever the position will allow, a scattering of the guns is preferable to placing them close together. A disposition of this kind does not exclude a concentration of the fire from all guns, while it renders it more difficult for the enemy to effect a concentration of his fire on any one battery.

11. The armament of strand-batteries must greatly depend on their elevation above the water-level. During the American war, smooth-bore guns of heavy calibre (10-inch, 11-inch, and 15-inch) did most excellent execution in low-water batteries. The effect of an 11-inch or 15-inch shot against the turret of a Monitor is to loosen the rivets and bolts of the plating, to jar and derange the machinery of the turret, and to spread the effect of the force of its blow over a large surface, rendering the turret liable to being penetrated by the next shot striking near the same place. The accurate and plunging fire from rifled pieces, placed at a certain elevation over the level of the water, must have a most destructive effect on the decks of iron-clads; and for these reasons, a combination of low-water batteries, armed with 11-inch and 15-inch smooth-bore guns, and of higher placed batteries armed with rifled pieces of heavy calibre, appears to be the most judicious theory, wherever the ground will allow its being carried into effect. No iron-clad

could withstand the effect of a vertical fire from heavy pieces; but whether it will be possible or not to render the fire of mortars, by rifling them, accurate enough to justify their coming into general use in coast-defence against ships, future experiments alone will disclose.

CHAPTER V.

IV.—"*No Forts now built can keep out a large Fleet unless the Channel is obstructed.*"

REAR-ADMIRAL DAVID D. PORTER.

SUPPOSING :—

(*a.*) The circle of effective fire against iron-clads to have the radius $r = 1760$ yards;

(*b.*) A battery to be placed on the very edge of a narrow channel, and a vessel to be obliged to run nearly the full length of the diameter ($2\,r = 3520$ yards) of the above circle before passing its periphery a second time;

(*c.*) It to be possible to load, point, and fire a heavy gun once in every four minutes;

(*d.*) The speed of the vessel to be ten miles an hour.

The following deductions are made :—

1. The vessel will run the distance of 3520 yards in twelve minutes;

2. During this time she can be struck but four times from one and the same gun, viz.:

1st shot	at the	distance of	1760 yards.
2nd	"	"	586⅔ "
3rd	"	"	586⅔ "
4th	"	"	1760 "

Therefore, to hit each vessel of, for instance, the twenty that may compose a flotilla twenty times in twelve minutes, one hundred guns would be required in the shore-batteries; but twenty is the number of shots and shells that took effect on the *Hartford*, Admiral Farragut's flag-ship, during the naval combat on August 5th, 1865, in and after passing Fort Morgan. The *Hartford* was the most exposed vessel of the Federal fleet. The Confederates served their guns faithfully in spite of the torrent of shrapnell, grape, and shell raining on them from the passing ships: they had, by dint of long practice, become fine gunners. The engagement between the fort and the Federal fleet, and the Federal fleet and Admiral Buchanan's little squadron, lasted from 7.6 A.M. till 10.10 A.M., fifteen times twelve minutes, and yet there was not a single vessel in Farragut's fleet (the *Tecumseh*, sunk by a torpedo, excepted) that could not have continued the action; or if Dog River bar and the obstructions had allowed, run up to the upper batteries, engaging these also. The sinking of a vessel by artillery-fire alone is a more difficult thing than is commonly supposed by artillerymen, and is usually the result of a fortunate chance, which has directed the shot to some vital spot. The difficulty of taking accurate aim is considerably increased by the motion of the vessel endeavouring to force a passage, and the storm of missiles poured into the battery makes it no easy matter for the men to serve the guns with regularity and coolness.

As a proof that artillery-fire alone will never again prevent a steam-fleet from forcing a passage, the channel of which has not been obstructed, the following instances are given:—

1.—*Attack on, and passage of, Forts Jackson and St. Philip, on the Mississippi.*

(*a.*) FLAG-OFFICER FARRAGUT'S DETAILED REPORT OF THE BATTLES OF THE MISSISSIPPI.

"UNITED STATES' FLAG-SHIP *Hartford*,
"At anchor off the City of New Orleans, May 6th, 1862.

"SIR,—I have the honour herewith to forward my report, in detail, of the battle of New Orleans. On the 23rd of March I made all my arrangements for the attack on, and passage of, Forts Jackson and St. Philip.

"Every vessel was as well prepared as the ingenuity of her commander and officers could suggest, both for the preservation of life and of the vessel; and, perhaps, there is not on record such a display of ingenuity as has been evinced in this little squadron. The first was by the engineer of the *Richmond*, Mr. Moore, by suggesting that the sheet-cables be stopped up and down on the sides in the lines of the engines, which was immediately adopted by all the vessels. Then each commander made his own arrangements for stopping the shot from penetrating the boilers or machinery that might come in forward or abaft, by hammocks, coal, bags of ashes, bags of sand, clothes-bags, and, in fact, every device imaginable. The bulwarks were lined with hammocks by some, by splinter-nettings made with ropes by others. Some rubbed their vessels over with mud, to make their ships less visible, and some whitewashed their decks, to make things more visible by night during the fight, all of which you will find mentioned in the reports of the commanders. In the afternoon I visited each ship, in order to know positively that each commander understood my orders for the attack, and to see that all was in readiness. I had looked to their efficiency before. Every one appeared to understand their orders well, and looked forward to the conflict with firmness, but with anxiety, as it was to be in the night, or at two o'clock A.M.

"I had previously sent Captain Bell, with the petard man, with Lieutenant Commanding Crosby, in the *Pinola*, and Lieutenant Commanding Caldwell, in the *Itasca*, to break the chain which crossed the river, and was supported by eight hulks, which were strongly moored. This duty was not thoroughly performed, in consequence of the failure to ignite the petards with the galvanic battery, and the great strength of the current. Still it was a success, and, under the circumstances, a highly meritorious one.

"The vessel boarded by Lieutenant Commanding Caldwell appears to have had her chains so secured that they could be cast loose, which was done by that officer, and thereby making an opening sufficiently large for the ships to pass through. It was all done under a heavy fire, and a great hazard to the vessel, for the particulars of which I refer you to Captain Bell's report (marked A). Upon the night preceding the attack, however, I despatched Lieutenant Commanding Caldwell to make an examination, and to see that the passage was still clear, and to make me a signal to that effect, which he did at an early hour. The enemy commenced sending down fire-rafts and lighting their fires on the shore opposite the chain, about the same time, which drew their fire on Lieutenant Commanding Caldwell, but without injury. At about five minutes of two o'clock A.M., April 24th, signal was made to go under way (two ordinary red lights, so as not to attract the attention of the enemy), but owing to the great difficulty in purchasing their anchors, the *Pensacola* and some of the other vessels were not under way until half-past three. We then advanced in two columns, Captain Bailey leading the right in the gun-boat *Cayuga*, Lieutenant Commanding Harrison, he having been assigned to the first division of gun-boats, which was to attack Fort St. Philip, in conjunction with the second division of ships, and the *Hartford*, the left; Fleet-Captain Bell leading the second division of gun-boats in the *Sciota;* Lieutenant Commanding Donaldson to assist the first division of ships to attack Fort Jackson, as will be shown by the general order and diagram sent herewith. The enemy's lights, while they discovered us to them, were, at the same time, guides to us. We soon passed the barrier chains, the right column taking Fort St. Philip and the left Fort Jackson. The fire became general, the smoke dense, and we had nothing to aim at but the flash of their guns; it was very difficult to distinguish friends from foes. Captain Porter had, by arrangement, moved up to a certain point on the Fort Jackson side with his gun-boats, and I had assigned the same post to Captain Swartwout, in the *Portsmouth*, to engage the batteries to the southward and eastward of Fort Jackson, while his mortar-vessels poured a terrific fire of shells into it. I discovered a fire-raft coming down upon us, and in attempting to avoid it ran the ship on shore, and the ram *Manassas*, which I had not seen, lay on the opposite of it, and pushed it down upon us. Our ship was soon on fire half-way up to her tops, but we backed off, and through the good organization of our fire department, and the great exertions of Captain Wainwright, and his first lieutenant, officers, and crew, the fire was extinguished. In the meantime our battery was never silent, but poured in its missiles of death into Fort St. Philip, opposite to which he had got by this time, and it was silenced, with the exception of a gun now and then. By this time the enemy's gun-boats, some thirteen in number, besides two iron-clad rams, the *Manassas* and the *Louisiana*, had become more visible. We took them in hand, and in the course of a short time destroyed eleven of them. We were now fairly past the forts, and the victory was ours, but still here and there a gun-boat making resistance. Two of them had attacked the *Varuna*, which vessel, by her greater speed, was much in advance of us; they ran into her, and caused her to sink, but not before she had destroyed her adversaries, and their wrecks now lie side by side, a monument to the gallantry of Captain Boggs, his officers, and crew. It was a kind of guerilla; they were fighting in all directions. Captains Bailey and Bell, who were in command of the first and second divisions of gun-boats, were as active in rendering assistance in every direction as lay in their power. Just as the scene appeared to be closing, the ram *Manassas* was seen coming up under full speed to attack us. I directed Captain Smith, in the *Mississippi*, to turn and run her down; the order was instantly obeyed, by the *Mississippi* turning and going at her in full speed. Just as we expected to see the ram annihilated, when within fifty yards of each other, she put her helm hard aport, dodged the *Mississippi*, and ran ashore. The *Mississippi* poured two broadsides into her, and sent her drifting down the river. Thus closed our morning's work.

"The Department will perceive that after the organization and arrangements had been made, and we had fairly entered into the fight, the density of the smoke from guns and fire-rafts, the scenes passing on board our own ship and around us (for it was as if the artillery of heaven were playing upon the earth), that it was impossible for the flag-officer to see how each vessel was conducting itself, and can only judge by the final results and their special reports, which are herewith enclosed; but I feel that I can say with truth that it has rarely been the lot of a commander to be supported by officers of more indomitable courage, or higher professional merit.

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"D. G. FARRAGUT,
"Flag-Officer, Western Gulf Blockading Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington City, D.C."

(*b*.) REPORT OF COMMANDER RICHARD WAINWRIGHT.

"UNITED STATES' FLAG-SHIP *Hartford*,
"Off City of New Orleans, April 30th, 1862.

"SIR,—I have the honour to submit the following report of the part taken by this ship in the actions of the mornings of April 24th and 25th instant, off Forts Jackson and St. Philip, and below the city of New Orleans.

"At 3.30 A.M. on the morning of the 24th got under way, and at 3.55 the *Hartford* opened fire from bow guns, engaging Fort Jackson, and receiving a galling fire from both forts. At 4.15 grounded on shoal near Fort St. Philip, in the endeavour to clear a fire-raft, which was propelled by a ram on our port quarter, setting fire to the ship, the flames bursting through the ports and running up the rigging, endangering the ship as much from fire, if not more, than from the guns of the enemy. Went to 'fire-quarters,' extinguished flames, and backed off—a heavy fire being kept up by both forts upon us all the time, and we continuing to fire in return upon them until out of range. Passed and fired into several rebel steamers on our way up the river.

"On the 25th instant, steaming up the river, cleared ship for action at 9.30 A.M., and at 11.30 discovered two batteries, one on each bank of the river, which commenced firing. We then opened fire with bow guns, and shortly were in position to rake both batteries, and at first fire of the fort battery drove the enemy on the right bank from his guns. After passing, were fired on by riflemen, but without injury.

"The ship was much riddled, having received thirty-two shots, some of them of a serious nature. There were also two guns disabled by the enemy's fire.

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"R. WAINWRIGHT,
"Commander United States' Ship *Hartford*.

"FLAG-OFFICER FARRAGUT,
"Commanding Western Gulf Blockading Squadron."

(c.) REPORT OF CAPTAIN T. T. CRAVEN.

"UNITED STATES' STEAM-SLOOP *Brooklyn*,
"Mississippi River, off New Orleans, April 26th, 1862.

"SIR,— * * * * * *

"It becomes my duty to add that, on the morning of the 24th, soon after the action between our fleet and the Forts St. Philip and Jackson, commenced, in consequence of the darkness of the night and the blinding smoke, I lost sight of your ship, and when following in the line of what I supposed to be your fire, I suddenly found the *Brooklyn* running over one of the hulks and rafts which sustained the chain barricade of the river. For a few moments I was entangled, and fell athwart the stream, our bow grazing the shore on the left bank of the river. While in this situation I received a pretty severe fire from Fort St. Philip. Immediately after extricating my ship from the rafts, her head was turned up stream, and a few minutes thereafter she was feebly butted by the celebrated ram *Manassas*. She came butting into our starboard gangway, first firing from her trap-door, when within about ten feet of the ship, directly towards our smoke-stack, her shot entering about 5 feet above the water-line, and lodging in the sand-bags which protected our steam-drum. I had discovered this queer-looking gentleman, while forcing my way over the barricade, lying close into the bank, and when he made his appearance the second time I was so close to him that he had not an opportunity to get up his full speed, and his efforts to damage me were completely frustrated, our chain-armour proving a perfect protection to our sides. He soon slid off, and disappeared in the darkness. A few moments thereafter, being all the time under a raking fire from Fort Jackson, I was attacked by a large rebel steamer. Our port broadside, at the short distance of only 50 or 60 yards, completely finished him, setting him on fire almost instantaneously.

"Still groping my way in the dark, or under the black cloud of smoke from the fire-raft, I suddenly found myself abreast of St. Philip, and so close that the leadsman in the starboard chains gave the soundings, 'Thirteen feet, sir.' As we could bring all our guns to bear, for a few brief moments we poured in grape and canister, and I had the satisfaction of completely silencing that work before I left it, my men in the tops witnessing, in the flashes of their bursting shrapnells, the enemy running like sheep for more comfortable quarters.

"After passing the forts, we engaged several of the enemy's gun-boats; and being at short range—generally from 60 to 100 yards—the effects of our broadsides must have been terrific. This ship was under fire about an hour and a half. We lost eight men killed, and had twenty-six wounded; and our damages from the enemy's shot and shell are severe. I should not have been so particular, sir, in recording so many of the incidents of the morning of the 24th, had I not been out of my proper station; but justice to my officers and crew demands that I should show that the *Brooklyn* was neither idle nor useless on that never-to-be-forgotten occasion.

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"On the morning of the 25th of April, as the fleet was proceeding up the river, at about a quarter past eleven o'clock, two batteries were discovered, one on our starboard bow, and the other almost directly ahead. Signal was made from your ship to prepare for action. At this time the flag-ship was the leading vessel, the *Brooklyn* was the second in the line, and the *Iroquois* third; the others were astern, and somewhat scattered. A few minutes after your signal, the *Cayuga* passed the *Brooklyn*, and so close as to compel me to hail, and request her commander not to force me out of my station. She pushed on, and even passed the flag-ship.

"About noon, being then 1¼ mile distant from them, the batteries opened a raking fire upon us. The fire of the starboard battery was immediately responded to by this ship, then about half-a-cable's length astern of the *Hartford*, and twenty-one shots from our 80-pounder rifled gun were rapidly, and with remarkable precision, thrown into it, only two of these shots failing to take effect. A few minutes afterwards, the *Brooklyn*, then steaming at the rate of ten knots, by the sudden sheering off and slowing down of the *Hartford*, for the purpose of engaging the enemy, necessarily sheered in shore, which brought her up within 150 or 200 yards of the port-hand battery, and so as to obstruct the fire of the *Hartford*. The *Brooklyn* then opened fire with grape and canister, stopped her engines, and, lying within less than 100 yards of the river bank, delivered two other broadsides. * * *

"THOS. T. CRAVEN, Captain.

"FLAG-OFFICER D. G. FARRAGUT,
"Commanding Western Gulf Blockading Squadron."

(*d*.) REPORT OF COMMANDER CHARLES S. BOGGS.—LOSS OF UNITED STATES' STEAMER *Varuna*.

"UNITED STATES' STEAMER *Brooklyn*,
"Off New Orleans, April 29th, 1862.

"SIR,—I have the honour to report that, after passing the batteries with the steamer *Varuna*, under my command, on the morning of the 24th, finding my vessel amid a nest of rebel steamers, I started ahead, delivering her fire, both starboard and port, at every one that she passed. The first on her starboard beam that received her fire appeared to be crowded with troops. Her boiler was exploded, and she drifted to the shore. In like manner, three other vessels, one of them a gunboat, were driven ashore in flames, and afterwards blew up.

"At six A.M. the *Varuna* was attacked by the *Governor Moore*, iron-clad about the bow, commanded by Beverly Kennon, an ex-naval officer. This vessel raked us along the port gangway, killing four, and wounding nine of the crew, butting the *Varuna* on the quarter, and again on the starboard side. I managed to get three 8-inch shells into her abaft her armour, as also several shots from the after rifle-gun, when she dropped out of action partially disabled.

"While still engaged with her, another rebel steamer, iron-clad, with a prow under water, struck us in the port gangway, doing considerable damage. Our shot glanced from her bow. She backed off for another blow, and struck again in the same place, crushing in the side; but by going ahead fast, the concussion drove her bow around, and I was able, with the port guns, to give her, while close alongside, five 8-inch shells abaft her armour. This settled her, and drove her ashore in flames. Finding the *Varuna* sinking, I ran her into the bank, let go the anchor, and tied up to the trees.

"During all this time the guns were actively at work crippling the *Governor Moore*, which was making feeble efforts to get up steam. The fire was kept up until the water was over the gun-trucks, when I turned my attention to getting the wounded and crew out of the vessel. The *Oneida*, Captain Lee, seeing the condition of the *Varuna*, had rushed to her assistance, but I waved her on, and the *Governor Moore* surrendered to her, the vessel in flames.

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"In fifteen minutes from the time the *Varuna* was struck she was on the bottom, with only her top-gallant forecastle out of water.

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"CHARLES S. BOGGS,
"Commander United States' Navy.

"FLAG-OFFICER D. G. FARRAGUT,
"Commanding Western Gulf Blockading Squadron."

(e.) Commander Porter's detailed Report.

"United States' Steamer *Harriet Lane*,
"Forts Jackson and St. Philip, April 30th, 1862.

"Sir,—I have the honour to lay before you a report of the proceedings of the mortar-flotilla under my command since the day the vessels entered the Mississippi River.

"On the 18th of March all the mortar fleet crossed '*Pass à l'outre*' bar, towed by the *Harriet Lane*, *Owasco*, *Westfield*, and *Clifton*, the two latter having arrived that morning. I was ordered by the Flag-Officer Farragut to proceed to South-west Pass, which I accordingly did; there we awaited orders, being at any moment ready to go to work on the fort.

"As yet only the *Brooklyn* and *Hartford* had crossed the bar; a short time after the *Richmond* passed over, and then the *Mississippi* and the *Pensacola* came from Ship Island to try their hand at getting through. There was not at the time a great depth of water, and their pilots were not at all skilful or acquainted with the bar. I volunteered my services with the steamers belonging to the mortar-flotilla, and after eight days' laborious work, succeeded in getting the ships through, and anchored them at Pilot Town. I do not hesitate to say, but for the exertions of Commander Renshaw, Lieutenant Commanding Baldwin, and Lieutenant Commanding Wainwright, that the two latter ships would never have got inside; the *Miami*, Lieutenant Commanding Harrell, also rendered assistance; but as his vessel was an unmanageable one, he could do no more than act as a stream-anchor to heave the ships ahead by.

"Too much praise cannot be awarded to the commanders of the *Westfield* and *Clifton* (Renshaw and Baldwin) for the exertions they displayed on this occasion. They knew that the success of the expedition depended on getting these ships over, and they never once faltered in their duty, working against adverse circumstances, and impeded by a fog of eight days' duration, which obscured a vessel at the distance of 50 yards. The *Harriet Lane* also did all she could with her small power; and in the end the united power of these vessels succeeded in getting over the bar the heaviest vessels that ever entered the Mississippi River.

"When the ships were all ready to move up, I directed Mr. Gerdes (assistant on the Coast Survey) to proceed in the *Sachem*, and make a minute survey from 'Wiley's Jump' up to the forts. He detached Mr. Oltmanns and Mr. Harris, the first an assistant on the Coast Survey, the latter sent out by the superintendent (Mr. Archibald Campbell) of the north-western boundary, to perform what might be required of him. The work was performed in boats; Lieutenant Commanding Guest, in the *Owasco*, being detailed by me for the purpose of protecting them. These two gentlemen, Messrs. Harris and Oltmanns, performed their duty most admirably. In three days they had surveyed and triangulated over 7 miles of the river, their observations taking in Forts Jackson and St. Philip. Much of this time they were under fire from shot and shell at a distance of 2600 yards, and were exposed to concealed riflemen in the bushes. On one occasion, Mr. Oltmanns was fired upon from the bushes while surveying in one of the *Owasco's* boats, one of the balls striking an oar; but the boat's crew drove the enemy off with their rifles, and Mr. Oltmanns proceeded with his work, establishing the position the mortar vessels were to occupy with great coolness and precision. I deem it due to these gentlemen to mention their names honourably as a tribute to the Coast Survey—the utility of which is not properly appreciated—and as a mark of high satisfaction with them for their invaluable services.

"The survey being completed, and marked positions being assigned to the vessels when their distance from the fort could be known to a yard, I brought up three of the schooners to try their range and durability at a distance of 3000 yards. I found the range satisfactory, and had no reason to doubt the durability of the mortar-beds and foundation. I received but little encouragement from any one about the success of the mortars, it having been confidently predicted that the bottoms of the schooners would drop out at the tenth fire. I had no doubts myself about the matter, having perfect confidence in the schooners. Lieutenant Commanding John Guest guarded the Coast Survey party while they were employed, returning the enemy's fire whenever he thought he could do so with effect.

"On the 16th Flag-Officer Farragut moved up the fleet, and I was told to commence operations as soon as I was ready.

"The schooners sailed up partly or were towed by the steamers, and on the morning of the 18th they had all reached their positions ready to open fire. Previous to taking their places I had directed their masts to be dressed off with bushes, to make them invisible to the enemy and intermingle with the thick forest of trees and matted vines behind which they were placed. This arrangement proved to be an admirable one, for never once during the bombardment was one of the vessels seen from the forts, though their *approximate* position was known. As the bushes were blown away during the bombardment they were renewed, and the masts and ropes kept covered from view. The place I selected for the mortar-vessels was under the lee of a thick wood closely interwoven with vines, and presenting in the direction of Forts Jackson and St. Philip an impenetrable mass for three hundred yards, through which shot could scarcely pass. From our mastheads the forts could be plainly seen, though observers there could not see us in return. The head vessel of the first division, Lieutenant Commanding Watson Smith, was placed at this point, 2850 yards from Fort Jackson, 3680 from St. Philip; the vessels were then dropped in a line close to each other, their positions having been marked by the Coast Survey party, and Messrs. Oltmanns and Harris superintending personally that each one was acquainted with the proper distance. Next to Lieutenant Commanding Smith's division of seven vessels (*Norfolk Packet*, Lieutenant Commanding

Watson Smith; *Oliver H. Lee*, Acting-Master Washington Godfrey; *Para*, Acting-Master Edward G. Furber; *C. P. Williams*, Acting-Master Amos R. Langthorne; *Arletta*, Acting-Master Thomas E. Smith; *William Bacon*, Acting-Master William P. Rogers; *Sophronia*, Acting-Master Lyman Bartholomew) was placed the six vessels of the third division, under Lieutenant Commanding K. R. Breese (*John Griffith*, Acting-Master Henry Brown; *Sarah Bruen*, Acting-Master Abraham Christian; *Racer*, Acting-Master Alvin Phinney; *Sea Foam*, Acting-Master Henry E. Williams; *Henry James*, Acting-Master Lewis W. Pennington; *Dan. Smith*, Acting-Master George W. Browne), and one vessel, the *Orvetta*, Acting-Master Blanchard, all lying in line close together.

"All the vessels mentioned were anchored and secured to spring their broadsides, as occasion might require. In the mean time Lieutenant Commanding John Guest was sent ahead in the *Owasco* to clear the bushes of riflemen which had been found to lurk there, and cover the vessels from the fire of the forts when it should open; the *Westfield*, *Clifton*, and *Miami* being engaged in towing the vessels to their posts.

"I placed six vessels of the second division, under command of Lieutenant W. W. Queen, on the north-east shore of the river, the headmost one 3680 yards from Fort Jackson, to which the division was directed to turn its attention. The following vessels and acting-masters composed the division:—

"*T. A. Ward*, W. W. Queen, commanding Second Division.

"*M. J. Carlton*, Charles E. Jack, Acting-Master.

"*Matthew Vasser*, Hugh H. Lavage, Acting-Master.

"*George Mangham*, John Collins, Acting-Master.

"*Orvetta*, Francis E. Blanchard, Acting-Master.

"*Sidney C. Jones*, J. D. Graham, Acting-Master.

"When the divisions were all placed, signal was made to commence action, and they opened in order, each one firing every ten minutes. The moment the mortars opened, Forts Jackson and St. Philip responded with all their guns that could bear, but for some time did not appear to get the right range; the hulls of the vessels on the north-east shore being covered with reeds and willows, deceived them somewhat, though their shot and shell went over. The fire of the enemy was rapid, and as the shell and shot began to grow rather hot, I sent to the flag-officer asking that some of the gun-boats should be sent to draw their fire. For one hour and fifty minutes Lieutenant Commanding Guest had, at the head of the mortar-fleet, borne the fire of the forts uninjured, and only left there to get a supply of ammunition. After I went on board his vessel and ordered him to retire, the mortar-vessels having been reinforced by the gun-boats sent up by the flag-officer, by midday the fire on the vessels on the north-east shore (Lieutenant Commanding Queen's division) became so rapid, and the shot and shell fell so close, that I went on board to move them. One large 120-pound shell had passed through the cabin and damaged the magazine of Lieutenant Commanding Queen's vessel, the *T. A. Ward*, coming out near the water-line, her rigging was cut, and shot flying over her fast. The *George Mangham*, Acting-Master John Collins, had received a 10-inch shot near her water-line, so I moved them both (contrary to the wishes of the officers) two hundred yards further astern, throwing the enemy out of his range, which he did not discover for two or three hours. At five o'clock in the evening the fort was discovered to be in flames, and the firing of the enemy ceased. We afterwards learned that the citadel had been fired by our bomb-shells, and all the clothing of the troops and commissary-stores had been burnt up, while great distress was experienced by the enemy owing to the heat and danger to the magazine. Had I known the extent of the fire, I should have proceeded all night with the bombardment; but the crews had had nothing to eat or drink since daylight. I knew not how much the mortar-beds and vessels might have suffered. Night firing was uncertain, as the wind had set in fresh, and not knowing how long a bombardment I might have to go through with, I deemed it best to be prudent. A little after sunset I ordered the firing to cease, and made the only mistake that occurred during the bombardment. The fire in the forts blazed up again at night, but I thought it one of the fire-rafts they lighted up every night at the fort.

"The first and third divisions, under Lieutenants Commanding Smith and Breese, acquitted themselves manfully that day, and though the shot and shell fell thick about them, behaved like veterans. We fired on this day over 1400 shells, many of which were lost in the air owing to bad fuzes. No accident of any kind occurred from careless firing, and after a careful examination, the vessels and mortar-beds were found to be uninjured. On that night, at two o'clock, I ordered Lieutenant Commanding Queen to drop out of the line of fire, and I placed him on the south shore, in a safer and closer position, though not one where he could work to such advantage, the fort being plainly visible from his late position, and the effect of the shells could be more plainly noted. On the south shore the pointing of the mortars could only be done from sights fixed to the mastheads, and many curious expedients were resorted to to obtain correct firing—expedients very creditable to the intelligence of the commanders of the vessels. We heard afterwards that our first day's firing had been more accurate than that of any other day, though it was all good.

"On the morning of the 19th we opened fire on the enemy again, when he tried his best to dislodge us from behind our forest protection without effect; our fire was kept up as rapidly as the men could carefully and properly load, the enemy returning it with what heavy guns he could bring to bear on us, most of his shot going over us amongst the shipping and gunboats, which were on guard and employed drawing the fire away from us. About nine o'clock on the second morning the schooner *Maria J. Carleton*, Charles Jack, master, was sunk by a rifle-shell passing down through her deck, magazine, and bottom. I happened to be alongside at the time and had nearly all the stores saved, also the arms. As she went down, the mortar was fired at the enemy for the last time, and that was the last of the *Carleton*. We hauled her on to the bank when we found that she was sinking, and were thus enabled to save many of her stores, but she finally slipped off the bank into deeper water, and nothing was left visible but her upper rail.

"Two men were wounded in the *Carleton*. Acting-Master Charles Jack came out in this vessel from New York; he lost his mainmast in a gale off Cape Hatteras, but persevered until he arrived in Key West, and sailed with the flotilla to Ship Island. He went through another gale, but got into port safe. He was almost always up with the rest in working up the river under sail with his one mast; and when his vessel sunk, he volunteered his services on board the vessel of Lieutenant Commanding Queen, to whose division he belonged. On the second day the firing from the forts was rather severe on the masts and rigging of the first division. I wanted to remove them a little further down, but was prevented from doing so at the request of Lieutenant Commanding Smith, who seemed determined not to withdraw until something was sunk. He had one man killed in the *Arletta*, Acting-Master Smith, by a 10-inch shot striking between the stop of the mortar-bed and the mortar, which disabled it for a time only; it was repaired in two or three hours, the men meanwhile under fire without any occupation to keep up their interest. One or two men were wounded this day. We had another conflagration in the fort, the shells having set fire to some quarters put up for officers on the north-west angle of the works: they were all consumed. The firing seemed to be good this day, though some said the shells went over, and others said they fell short. The proof of accuracy was, that the batteries were silenced every time the shells were concentrated on any one point. The fuzes being so bad, I gave up the plan of timing them, and put in *full-length fuzes*, to burst after they had entered the ground.

"In some respects this was disadvantageous, but we lost but few by bursting before time in the air. The ground being wet and soft, the shells descended 18 and 20 feet into the ground, exploding after some time, lifted the earth up, and let it fall back into its place again, not doing a great deal of harm, but demoralizing the men, who knew not what the consequences might be. The effect, I am told, was like that of an earthquake. When the shells hit the ramparts they did their work effectually, knocking off large pieces of the parapet, and shattering the casemates. On the third and fourth days the ammunition on board began to grow short, and the steamers had to be sent down to bring it up, the boats of the squadron also assisting all they could in the strong current to supply the vessels. The steamers lay close to the mortar-vessels, while the shot and shell were flying all about; but, strange to say, not a vessel was struck, though I expected to see some of them injured. The employment of them in that way could not be avoided. Everything was conducted with the greatest coolness, and the officers and men sat down to their meals as if nothing was going on—shells bursting in the air and falling alongside, and shot and rifle-shell crashing through the woods, and tearing the trees up by the roots. On the fifth day the fire from the forts on the head of the first division was very rapid and troublesome, one hundred and twenty-five shots fell close to the vessels in one hour and thirty minutes, without, however, doing them any damage, beyond hitting the *Para*, the headmost vessel, and cutting up the rigging and masts. The fire of the enemy had been attracted to the mastheads of one of the large ships which had been moved up, and which they could see over the woods. I deemed it prudent to move three of them two or three lengths, much to the annoyance of the officers, who seemed indisposed to yield an inch. Still, my duty was to look out for the vessels, and not have them destroyed. The *Norfolk Packet* got a piece of a shell through her decks, and had her rigging and crosstrees cut away, and one man wounded. For three days and nights the officers and men had had but little repose, and but few comfortable meals, so I divided the divisions into three watches of four hours each, firing from one division about 168 times a watch, or altogether, during twenty-four hours, 1500 shell. This I found rested the crews and produced more accurate firing. Overcome with fatigue, I had seen the commanders and crews lying fast asleep on deck, with a mortar on board the vessel next to them thundering away, and shaking everything around them like an earthquake. The windows were broken at the Balise, thirty miles distant. It would be an interminable undertaking, sir, if I were to attempt to give a minute account of all the hard work performed in the flotilla, or mention separately all the meritorious acts and patient endurance of the commanders and crews of the mortar-vessels. All stuck to their duty like men and Americans; and though some may have exhibited more ingenuity and intelligence than others, yet the performance of all commanded my highest admiration. I cannot say too much in favour of the three commanders of divisions, Lieutenants Watson Smith, W. W. Queen, and K. R. Breese. I can only say I would like always to have them at my side in times of danger and difficulty. They were untiring in their devotion to their duties, directing their officers, who could not be supposed to know as much about their duties as they did. I left the entire control of these divisions to themselves, trusting implicitly that they would faithfully carry out the orders which I had given them previous to the bombardment, and knowing that no powder or shell would be thrown away if they could help it. The end justified my confidence in them. During a bombardment of six days they were constantly exposed to a sharp fire from heavy guns. If they sustained no serious damage to their vessels it was no fault of the enemy, who tried his best to destroy them, and who, after I had withdrawn the vessels of Lieutenant Commanding Queen from a very exposed position, reported that he had sunk them.

"After bombarding the fort for three days I began to despair of taking it, and, indeed, began to lose my confidence in mortars, but a deserter presented himself from Fort Jackson, and gave me such an account of the havoc made by our mortar-practice, that I had many doubts at first of his truth. He represented hundreds of shells falling into the fort, casemates broken in, citadel and outbuildings burnt, men demoralized and dispirited, magazine endangered, and the levee cut. We went to work with renewed vigour, and never flagged to the last.

"On the night of the 20th an expedition was fitted out, under Commander Bell, for the purpose of breaking the chain; it was composed of the gun-boats *Pinola* and *Itasca.* It was arranged that all the mortars should play upon the fort while the operation was going on, which they did as fast as they could safely load and fire, nine shells being in the air frequently at one time. The vessels were discovered, and the forts opened fire on them at a distance of from three to eight hundred yards. Lieutenant Crosby informed me that but for the rapid and accurate fire of the mortars the gun-boats would have been destroyed. The mortars silenced the batteries effectually, and Colonel Higgins ordered the men into the casemates, where they were in no way loth to go. These facts have been obtained from prisoners. The *Itasca*, Lieutenant Caldwell, slipped the chain of one vessel, and was swept ashore by the current, when the *Pinola*, Lieutenant Commanding Crosby, got her off, both remaining in that position over thirty minutes, though seen by the enemy and seldom fired at.

"On the 23rd I urged Flag-Officer Farragut to commence the attack with the ships at night, as I feared the mortars would not hold out; the men were almost overcome with fatigue, and our supply-ships laid a good way off. The enemy had brought over two heavy rifle-guns to bear on the head of our line, and I was aware that he was daily adding to his defences, and strengthening his naval forces with iron-clad batteries. The 23rd was appointed, but the attack did not come off. I had fortunately dismounted with a shell, on that day, the heaviest rifle-gun they had on St. Philip, breaking it in two, and it annoyed us no more. I did not know it at the time, but thought the ammunition had given out. On the 23rd the order was given to move at two o'clock, in the order which flag-officer will mention in his report. The steamers belonging to the mortar-flotilla were assigned the duty of enfilading a heavy water-battery of six guns, and the barbette of guns which commanded the approach to the forts; and the mortars having obtained good range during the day, were to try to drive the men from the guns by their rapid fire, and bursting shells over the parapets. The flotilla steamers, composed of the *Harriet Lane*, Lieutenant Commanding Wainwright, leading; *Westfield*, Commander Renshaw; *Owasco*, Lieutenant Commanding Guest; *Clifton*, Lieutenant Commanding Baldwin; and *Miami*, Lieutenant Commanding Harrell, moved up (when the flag-officer lifted his anchor), 70 fathoms apart, and took position under the batteries; the leading vessel 500 yards off, the others closing up as the fire commenced. Then, as soon as the *Hartford*, *Brooklyn*, and *Richmond* passed, they opened with shrapnell on the forts, having received the fire ten or fifteen minutes before replying to it. As the fire was high, and they were close in shore, nearer the forts than the enemy supposed, they occupied, as it turned out, a safer position than the vessels further out, there being only one killed and one wounded on board the *Harriet Lane*, while the other steamers remained untouched. The commanders of all the vessels on this occasion did their duty, coolly kept their vessels close up, fired rapidly and accurately, and the signal was not made to retire until the last vessel of our gallant squadron passed through the flames, which seemed to be literally eating them up; every man, spar, or rope was plainly seen amid the light, and every movement of the ships noted; that last vessel, the elegant *Iroquois*, would provokingly linger and slow her engines opposite the forts to give the rebels a taste of her formidable battery. When she also disappeared in the smoke, our signal was hung out to retire, our duty having been accomplished, and the fort turning its entire attention to our little force. It could not, however, do us much harm, as the rain of mortar-shells almost completely silenced them. Never in my life did I witness such a scene, and never did rebels get such a castigation. Colonel Higgins ordered the men from the batteries into the casemates to avoid the mortar-shells, which fell with particular effect on that night, while grapeshot and shrapnell from the ships gave them but few opportunities to fire from their casemates. The ships had gone by, the backbone of the rebellion was broken, the mortars ceased their fire, and nothing was heard for a time but the booming of guns as our fleet went flying up the river, scattering the enemy's gun-boats, and sinking them as they passed. We all sat down to rest and speculate on the chances of seeing our old friends and brother officers again.

"I was very hopeful myself, for I knew that the enemy had been too much demoralized during the last week by mortar-practice to be able to stand against the fire of our ships. I gave the ships, when they started, forty-five minutes to pass the forts, they were only seventy from the time they lifted their anchors. I lost the services of a well-armed and useful vessel, the *Jackson*, for the attack on the batteries. Her commander, Lieutenant Commanding Woodworth, during the affair, was appointed to tow the *Portsmouth* ahead of the mortar steamers, but was carried down the stream. He persisted, however, in taking her into her berth after the battle was over, and the steamers had retired, and anchored her, I believe, within nine hundred yards of the fort. His reception, and that of the *Portsmouth*, was a warm one, for the east batteries opened on them; and, after escaping miraculously, the *Portsmouth*, with some shots in her hull and rigging, and one or two killed and wounded, coolly drifted out from under the guns, and took her old position. Had the rebels not been overcome with despair she would have fared badly.

" Immediately on the passage of the ships, I sent Lieutenant-

Commanding Guest up with a flag of truce, demanding the surrender of the forts. The flag of truce was fired on, but apologized for afterwards. The answer was—'The demand is inadmissible.' Giving the men that day to rest, I prepared to fill up the vessels with ammunition, and commence the bombardment again. Having in the mean time heard from Flag-Officer Farragut that he had safely passed the batteries, I determined to make another attempt on these deluded people in the forts to make them surrender, and save the further effusion of blood. Flag-Officer Farragut had unknowingly left a troublesome force in his rear, consisting of four steamers and a powerful steam-battery of four thousand tons and sixteen heavy guns, all protected by the forts. I did not know in what condition the battery was, only we had learned that she came down the night before, ready prepared to wipe out our whole fleet. If the enemy counted so surely on destroying our whole fleet with her, it behoved me to be prudent, and not let the mortar-vessels be sacrificed like the vessels at Norfolk. I commenced, then, a bombardment on the iron-clad battery, supposing it lay close under Fort Jackson, and also set the vessels to work throwing shells into Fort Jackson again, to let them know that we were still taking care of them; but there was no response; the fight had all been taken out of them. I sent the mortar-vessels below to refit and prepare for sea, as also to prevent them from being driven from their position in case the iron battery came out to attack them. I felt sure that the steamers alone could manage the battery. Six of the schooners I ordered to proceed immediately to the rear of Fort Jackson and blockade all the bayous, so that the garrison could not escape or obtain supplies. I sent the *Miami* and *Sachem* to the rear of Fort St. Philip to assist in landing troops. These vessels all appeared at their destination at the same time, and when morning broke, the enemy found himself hemmed in on all sides. It was a military necessity that we should have the forts. Our squadron was cut off from coal, provisions, and ammunition; our soldiers had but little chance to get to New Orleans through shallow bayous; the enemy in the city would hesitate to surrender while the forts held out; communication was cut off between them, and neither party knew what the other was willing to do. So I demanded a surrender again, through Lieutenant Commanding Guest, offering to let them retain their side-arms, and engage not to serve against the United States during the rebellion until regularly exchanged, provided they would honourably deliver up, undamaged, the forts, guns, muskets, provisions, and all munitions of war, the vessels under the guns of the fort, and all other public property. The answer was civil, and hopes were held out that, after being instructed by the authorities of New Orleans, they would surrender. In the mean time their men became dissatisfied at being so surrounded; they had no hope of longer holding out with any chance of success, and gave signs of insubordination. On the 28th, a flag of truce came on board the *Harriet Lane,* proposing to surrender Jackson and St. Philip on the terms proposed, and I immediately proceeded to the forts with the steamers *Westfield, Winona,* and *Kennebec* in company, and sent a boat for General Duncan and Lieutenant-Colonel Higgins, and such persons as they might see fit to bring with them. These persons came on board, and, proceeding to the cabin of the *Harriet Lane*, the capitulation was drawn up and signed, the original of which I have had the honour of forwarding to the Department by Captain Bayley, no opportunity occurring to send it through Flag-Officer Farragut without loss of time. The officers late commanding the forts informed me that the vessels would not be included in the capitulation, as they (the military) had nothing to do with the naval officers, and were in no way responsible for their acts.

" There was evidently a want of unanimity between the different branches of the rebel service. I afterwards found out that great ill-feeling existed,—the naval commander having failed, in the opinion of the military, to co-operate with the forts; the true state of the case being, that they were both sadly beaten, and each laid the blame on the other. While engaged in the capitulation, an officer came below and informed me that the iron floating-battery (the *Louisiana*) had been set on fire by two steamers which had been lying alongside of her. This was a magnificent iron steam floating-battery of four thousand tons, and mounting sixteen heavy guns, and perfectly shot-proof. She had been brought down from New Orleans the day before, and on it the hopes of their salvation seemed to depend, as will appear by the following letter from General Duncan, taken in the fort:—

" 'FORT JACKSON, LOUISIANA, April 22nd, 1862.

" 'CAPTAIN,—Your note of this date relative to the steamer *Louisiana*, the forwardness of her preparations for attack, the dispositions to be made of her, &c., has been received. It is of vital importance that the present fire of the enemy should be withdrawn from us, which you alone can do. This can be done in the manner suggested this morning, under the cover of our guns, while your work on the boat can still be carried on in safety and security. Our position is a critical one, dependent entirely on the powers of endurance of our casemates, many of which have been completely shattered, and are crumbling away by repeated shocks, and therefore I respectfully, but earnestly, again urge my suggestions of this morning upon your notice. Our magazines are also in danger.

" 'Very respectfully, your obedient servant,

" 'J. K. DUNCAN,

" 'Brigadier-General.

" 'CAPTAIN J. R. MITCHELL,
" 'Commanding Naval Forces, Lower Mississippi River.'

" I was in hopes of saving this vessel as a prize, for she would have been so materially useful to us in all future operations on the coast, her batteries and strength being sufficient to silence any fort here, aided by the other vessels. Seeing her lying so quiet, with colours down, and the two steamers under our guns, I never dreamed for a moment that they had not surrendered. The forts and ourselves had flags of truce flying, and I could not make any movement without violating the honour of the United States, and interrupting the capitulation which was being drawn up. The burning of the vessels was done so quietly that no one suspected it until the battery was in a blaze. I merely remarked to the commanders of the forts that the act was in no way creditable to the rebel commander. The reply was—'We are not responsible for the acts of these naval officers.' We proceeded with the conference, and while so engaged, an officer came to inform me that the iron-clad battery was all in flames, and drifting down on us, having burnt the ropes that had fastened her to the bank. I inquired of the late commanders of the forts if they knew if the guns were loaded, or if she had much powder on board. The answer was—'I presume so; but we know nothing about the naval matters here.' At this moment, the guns, being heated, commenced going off, with a probability of throwing shot and shell amidst friend and foe. I did not deign to notice it further than to say to the military officers—'If you don't mind the effects of the explosion which is soon to come, we can stand it.' If the ever-memorable Commander Mitchell calculated to make a stampede in the United States' vessels by his infamous act, he was mistaken; none of them moved or intended to move, and the conference was carried on as calmly as if nothing else was going on, though proper precautions were taken to keep them clear of the burning battery. A good Providence, which directs the most unimportant events, sent the battery off towards Fort St. Philip, and as it got abreast of that formidable fort, it blew up with a force which scattered the fragments in all directions, killing one of their own men in Fort St. Philip, and when the smoke cleared off it was nowhere to be seen, having sunk immediately in the deep water of the Mississippi. The explosion was terrific, and was seen and heard for many miles up and down the river. Had it occurred near the vessels it would have destroyed every one of them. This, no doubt, was the object of the arch-traitor who was the instigator of the act. He failed to co-operate, like a man, with his military confederates, who looked to the means he had at his disposal to save them from destruction, and who scorned alike his want of courage in not assisting them, as well as the unheard-of and perfidious act which might, in a measure, have reflected on them.

"How different was the course of the military commanders, who, though engaged in so bad a cause, behaved honourably to the end. Every article in the fort was delivered up undamaged. Nothing was destroyed, either before the capitulation or while the capitulation was going on, or afterwards. The most scrupulous regard was paid to their promises. They defended their works like men, and had they been fighting for the flag under which they were born instead of against it, it would have been honour enough for any man to have said he had fought by their side.

"After the capitulation was signed, I sent Commander W. B. Renshaw to Fort Jackson, and Lieutenant Commanding Ed. Nichols to Fort St. Philip, to receive the surrender of the forts. The rebel flag was hauled down and the stars and stripes once more floated over the property of the United States. The sun never shone on a more contented and happy-looking set of faces than those of the prisoners in and about the forts. Many of them had not seen their families for months, and a large portion had been pressed into a service distasteful to them, subject to the rigour of a discipline severe beyond measure. They were frequently exposed to punishments for slight causes, which the human frame could scarcely endure, and the men who underwent some of the tortures mentioned in a list of punishments I have in my possession, must have been unable afterwards to do any duty for months to come. Instead of the downcast countenances of conquered people, they emerged from the fort (going home on their parole) like a parcel of happy school-boys in holiday times, and no doubt they felt like them also.

"When the flags had been exchanged I devoted my attention to Commander Mitchell, who was lying a half mile above us with three steamers, one of which he had scuttled. Approaching him in the *Harriet Lane*, I directed Lieutenant Commanding Wainwright to fire a gun over him, when he lowered his flag. I then sent Lieutenant Commanding Wainwright on board to take possession, and receive the unconditional surrender of the party, consisting of fourteen naval officers and seven engineers, temporarily appointed; the crew of the iron-clad battery consisted of three hundred men and two companies of marine artillery, nearly all from civil life, and serving much against their will, so they said. Commander Mitchell and the other naval officers were transferred to the *Westfield* as prisoners of war, and as soon as time would allow the marines and sailors were sent in one of the captured vessels to Flag-Officer Farragut at New Orleans. The captured military officers were sent up to New Orleans on their parole; and thus ended the day on which the great Mississippi rejoiced once more in having its portal opened to the commerce of the world. The backbone of the rebellion was broken, and from the appearance and talk of the soldiers we might soon hope to see the people united again under the folds of the flag of the Union. While the capitulation was going on, I sent the steamer *Clifton* down to bring up troops, and when General Phelps came up, I turned the forts, guns, and munitions of war over to his keeping. My next step was to visit Forts Jackson and St. Philip. Never in my life did I witness such a scene of desolation and wreck as the former presented—it was ploughed up by the 13-inch mortars, the bombs had set fire to and burnt out all the buildings in and around the fort; casemates were crushed and were crumbling in, and the only thing that saved them were the sand-bags that had been sent from New Orleans during the bombardment, and when they began to feel the effects of the mortars. When the communication was cut off between them and the city, this resource of sand-bags could avail them no longer. It was useless for them to hold out; a day's bombardment would have finished them; they had no means of repairing damages; the levee had been cut by the 13-inch bombs in over a hundred places; and the water had entered the casemates, making it very uncomfortable, if not impossible, to live there any longer. It was the only place the men had to fly to out of reach of the bombs. The drawbridge over the moat had been broken all to pieces, and all the causeways leading from the fort were cut and blown up with bomb-shells, so that it must have been impossible to walk there, or carry on any operations with any degree of safety. The magazine seems to have been much endangered, explosions having taken place at the door itself; all the cotton bags and protections having been blown away from before the magazine door. Eleven guns were dismounted during the bombardment, some of which were remounted again and used upon us. The walls were cracked and broken in many places, and we could scarcely step without treading into a hole made by a bomb-shell. The accuracy of the fire is, perhaps, the best ever seen in mortar-practice; it seems to have entirely demoralized the men and astonished the officers. A water-battery, containing six very heavy guns, and which annoyed us at times very much, was filled with the marks of the bombs, no less than one hundred and seventy having fallen into it, smashing in the magazine and driving the people out of it. On the night of the passage of the ships this battery was completely silenced, so many bombs fell into it and burst over it. It had one gun in it, the largest I have ever seen, made at the Tredegar works. I would not pretend to say how many bombs fell in the ditches around the works, but soldiers in the fort say about three thousand; many burst over the works, scattering the pieces of shell all around. The enemy admit but fourteen killed and thirty-nine wounded by the bombardment, which is likely the case, as we found but fourteen fresh graves, and the men mostly stayed in the casemates, which were three inches deep with water and very uncomfortable. Many remarkable escapes and incidents were related to us as having happened during the bombardment. Colonel Higgins stated an instance where a man was buried deep in the earth by a bomb striking him between the shoulders, and directly afterwards another bomb exploded in the same place and threw the corpse high in the air. All the boats and scows around the ditches and near the landing were sunk by bombs; and when we took possession, the only way they had to get in and out of the fort to the landing was by one small boat to ferry them across. All the lumber, shingles, and bricks used in building or repairs was scattered about in confusion and burnt up, and every amount of discomfort that man could bear seemed to have been showered upon those poor deluded wretches.

"I was so much struck with the deserted appearance of what was once a most beautiful spot, that I ordered Mr. Gerdes and his assistants on the Coast Survey to make me an accurate plan of all the works, denoting every bomb that fell, and (as near as possible) the injury the fort had sustained, every distance being accurately measured by tape-line and compass, and the comparative size of fractures noted. The work has been executed with great zeal and accuracy, though it will only give a faint idea of the bombs that fell about the fort; many are lost sight of in the water, which has been let in by the cut levees; many burst over the fort; but enough have been marked to indicate the wonderful precision of the fire and the endurance of the forts. Had the ground been hard instead of being soft mud, the first day's bombardment would have blown Fort Jackson into atoms; as it is, it is very much injured, and will require thorough repair before it can be made habitable.

"Fort St. Philip received very little damage from our bombs, having fired at it with only one mortar, and that for the purpose of silencing a heavy rifled-gun which annoyed us very much. We were fortunate enough to strike it in the middle and break it in two, and had no more annoyance from that fort; two guns were capsized by a bomb at one time, but without injuring them; they were soon replaced; some trifling damage was done to the works, though nothing to affect the efficiency of the batteries. It was from Fort St. Philip that our ships suffered most, the men and officers there having had comparatively an easy time of it. I felt sure that St. Philip would surrender the moment Jackson hauled down the secession flag, and consequently directed all the attention of the mortar-schooners to the latter fort. The final result justified me in coming to this conclusion.

"I trust that you will excuse me, sir, for dwelling so minutely on matters relating to this important victory, though I have endeavoured to make my report as short as possible.

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"If the efforts of the mortar-flotilla have not met your expectations in reducing the forts in a shorter time, it must be remembered that great difficulties existed, first in the soil, which allowed the bombs to sink at least twenty feet by measurement before exploding; the difficulty of seeing the fort, as it is not much above the surrounding bushes, and the endurance of the casemates, which were deeply covered with earth, and better constructed than supposed; but I am firmly of opinion that the moral effect of this bombardment will go far towards clearing all forts of rebels, and I draw attention to the case of Fort Livingston, which held out a flag of truce the moment three mortar-vessels appeared before it. Flag-Officer Farragut has ordered me to repair to Ship Island, to await the arrival of the larger vessels, but not to commence any operations until he arrives.

"I herewith enclose the reports of the commanders of steamers, in relation to the conduct of those under their command.

"I have the honour to remain, very respectfully, your obedient servant,

"DAVID D. PORTER,
"Commanding Flotilla.

"HON. GIDEON WELLES,
"Secretary of the Navy."

2.—*Passing of the Batteries at Vicksburg.*

In his report of June 28th, 1862, Admiral Farragut says that he passed up the river in the morning, but to no purpose: "the enemy leave their guns for the moment, but return to them as soon as we have passed, and rake us."

The action of that day is described as follows :—

(*a.*) REPORT OF ADMIRAL FARRAGUT.

"UNITED STATES' FLAG-SHIP *Hartford*,
"Above Vicksburg, Mississippi, July 2nd, 1862.

"SIR,—In obedience to the orders of the Department, and the command of the President, I proceeded back to Vicksburg, with the *Brooklyn*, *Richmond*, and *Hartford*, with the determination to carry out my instructions to the best of my ability.

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"Captain D. D. Porter's mortar-flotilla, which was deemed indispensable to shell out the heights, had also to be towed up. All this caused great delay, but by the steady exertions of that officer, and the assistance of all in whose power it was to help, we succeeded in getting up sixteen mortar-vessels, and arrangements were soon made to bombard the forts on the heights of Vicksburg. Owing, however, to some imperfection in the fuzes (which Captain Porter will explain), he was two days getting his ranges. On the evening of the 27th, he reported to me that he was ready, and I issued my general order for the attack, on the 28th, at 4 A.M.

"At 2 A.M. on the 28th June, the signal was made to weigh, and we proceeded up to the attack in the order of steaming prescribed in the diagram accompanying the general order.

"At 4 o'clock, precisely, the mortars opened fire, and at almost the same moment the enemy fired his first gun, which was returned by the leading vessels: *Iroquois*, Commander J. S. Palmer; *Oneida*, Commander S. P. Lee, and *Richmond*, Commander James Alden. The other vessels, *Wissahickon*, Commander John de Camp; *Sciota*, Lieutenant Commanding Edward Donaldson; this ship, Commander R. Wainwright; *Winona*, Lieutenant Commanding E. T. Nichols; and *Pinola*, Lieutenant Commanding Pierce Crosby, next came up, and poured in their fire successively. At almost the same instant, Commander D. D. Porter came up on our starboard quarter with the *Octorara*, *Westfield*, *Clifton*, *Jackson*, *Harriet Lane*, and *Owasco*, and opened in fine style upon the enemy. The *Hartford* fired slowly and deliberately and with fine effect, far surpassing my expectations in reaching the summit batteries. The rebels were soon silenced by the combined efforts of the fleet and of the flotilla, and at times did not reply at all for several minutes, and then again at times replied with but one single gun.

"I passed up at the slowest speed (we had but eight pounds of steam), and even stopped once, in order that the *Brooklyn* and sternmost vessels might close up.

"The *Hartford* received but little injury from the batteries in or below the town, but several raking shots from the battery above the town did us considerable damage: they were 50-pounder rifle and 8-inch solid shot. The first passed through the shell-room in the starboard forward passage, and lodged in the hold, but did no other harm. The 8-inch struck the break of the poop, and passed through the cabin, but hurt no one; the rigging was much cut, and the main-topsail yard was cut in two.

"If the ships had kept in closer order, in all probability they would have suffered less, as the fire of the whole fleet would have kept the enemy from his guns a longer space of time, and when at his guns, his fire would have been more distracted.

"When we reached the upper battery, we soon silenced it, and it was reported to me that its flag was struck. We therefore gave three cheers; but when we had passed about three-quarters of a mile above, they re-opened fire with two heavy guns. I was unable to reply to this raking fire, being out of range. Although their shots were well directed, they either had too much or too little elevation, and only cut our rigging to pieces, without injuring any one seriously, which was strange, as the *Iroquois, Winona,* and *Pinola* were on our quarter.

"At 6 A.M., meeting with Lieutenant-Colonel Ellet, of the ram-fleet, who offered to forward my communication to Flag-Officer Davis and General Halleck, at Memphis, I anchored the fleet and went to breakfast, while I prepared my hasty despatch and telegram for the Department. I also sent across the peninsula to see what was the cause of Captain Craven and the vessels astern of him in the line not passing up. I also desired a list of their casualties, which appears to have been '*none.*' The casualties in the fleet, as far as heard from, in the passing vessels, were seven killed and thirty wounded. Commander Porter reports eight killed and ten or twelve wounded, but that was not his official report, probably, but referred more particularly to the two steamers, *Clifton* and *Jackson*, each of which had an accidental shot, the *Jackson* in the wheelhouse, killing the helmsman; and the *Clifton* a shot through her boiler, killing (by scalding) the men in her magazine, six in number, and one man was drowned by jumping overboard. I herewith forward the report of Acting-Lieutenant Commanding C. H. Baldwin, of the *Clifton.*

"The Department will perceive, from this (my) report, that *the forts can be passed, and we have done it, and can do it again as often as may be required of us.* It will not, however, be an easy matter for us to do more than silence the batteries for a time, so long as the enemy has a large force behind the hills to prevent our landing and holding the place.

(*b*.) REPORT OF COMMANDER RICHARD WAINWRIGHT.

"UNITED STATES' FLAG-SHIP *Hartford*,
"Above Vicksburg, June 29th, 1862.

"SIR,—I have the honour to report the part taken by this ship, in the battle of yesterday, in passing the forts at Vicksburg.

"We were under way before daylight, and reached the scene of action as day was breaking, when the enemy opened fire on us from his scattered batteries on shore. We returned it as they came in range, going at slow speed, our guns being worked with admirable coolness and deliberation, which was absolutely requisite, as we laboured under the great disadvantage of not knowing the situation of the batteries, which were only discovered by the flash and the smoke of their guns; some also were on high bluffs, rendering it difficult to elevate our guns to reach them.

"We were under fire about one hour and a half, receiving it on the broadside, and being raked ahead and astern. The enemy fired with great precision, and although we silenced some of their batteries, they returned to them when we had passed and our guns would no longer bear, and recommenced firing. We stopped opposite one of the lower batteries, more effectually to silence it. It would have been easy to have passed by the batteries under full steam and speed, with much less risk from the enemy's fire; but then our object would not have been gained in driving them away from their guns.

"We are much cut up, both in hull and rigging, which the enclosed reports of boatswain and carpenter will show.

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"R. WAINWRIGHT,
"Commander United States' Navy.

"FLAG-OFFICER D. G. FARRAGUT,
"Commanding Western Gulf Blockading Squadron."

(*c*.) INJURY SUSTAINED BY STEAMER *Clifton*, IN PASSING THE BATTERIES.

"UNITED STATES' STEAMER *Clifton*,
"Two miles below Vicksburg, June 28th, 1862.

"SIR,—I have the honour to report that this morning, at 3.45 A.M., in obedience to orders, we got under way, and proceeded in our station just astern of the *Westfield*, in the line headed by your own ship, to engage the batteries on the heights around Vicksburg. When within range, we opened our fire on the upper batteries on the hill from our rifled gun and forward 9-inch and forward 32-pounder, using 15-second shell. On receiving your orders, we directed our fire at the battery known as the 'water-battery,' advancing to within about 1200 yards, where we kept our station, using shrapnell from the 9-inch guns. At times, as opportunity offered, we used our after 9-inch guns. This we continued for some half to three-quarters of an hour, with, I think, good effect, until we were hailed by the *Jackson*, asking our assistance to tow them out of fire, that ship being temporarily disabled.

"While in the act of taking her line, we received a shot under the guard, just forward of the wheel, which, going through the ship's side, made its way into the end of the starboard boiler, and, partially coming out on the other side, caused such a rush of steam as to blow off, at once, the cover to the forward hatch, filling the forward berth-deck (under which is the forward magazine) with steam, and killing instantly six men. But one man from this division escaped, he being at the head of the ladder at the time. Some eight men from the forward pivot-gun jumped overboard to escape the steam. With the aid of the *Jackson's* boats, we were fortunate enough to recover all these, except John Connor, second-class fireman, who was drowned. This shot, which proved to be a 50-pound rifled shot, prevented any further movement of our wheels for the time. We, however, continued our fire from the forward and after thirty-twos, and after 9-inch guns, until you noticed our mishap, and came alongside to tow us out of action. At this period, the signal to retire was given.

"On examination of the injured boiler by the chief engineer of this ship, it is his opinion that the repairs to it will require at least ten days to complete, and will need the aid of a shop and experienced workmen. In the mean time the ship is ready for such service as she may be called upon to perform, which will not entail a greater speed than six knots an hour. This rate, I think, we shall be able to maintain.

"I have the honour to be, respectfully, your obedient servant,

"E. H. BALDWIN,
"Acting-Lieutenant Commanding.

"COMMANDER D. D. PORTER,
"Commanding Bomb-Flotilla."

(*d.*) COMMANDER D. D. PORTER'S REPORT OF THE OPERATIONS OF THE MORTAR-FLEET AT VICKSBURG.

"UNITED STATES' STEAMER *Octorora*,
"Vicksburg, July 3rd, 1862.

"SIR,—Agreeable to the orders received from you, I sailed from Pensacola on the 3rd of June, and on the 9th had all the mortar-vessels in New Orleans. On the 13th, sixteen vessels, in tow of the steamers, had left for Vicksburg, on half rations, the officers and men being desirous to arrive at the scene of action in good time. On the 20th we were before Vicksburg, ready for service, having met with no delay or accidents on the passage. On one occasion the flotilla was attacked with field-pieces at Ellis Bluffs, but the rebels were handsomely repulsed by the *Owasco* and *Jackson*, Lieutenants Commanding Guest and Woodworth. The mortar-schooners *George Mangham* and *Arletta*, Acting-Masters John Collins and Thomas E. Smith, and the *Horace Beales* and *Sarah Bruin*, Lieutenant Commanding Breese and Acting-Master A. Christian, were also attacked at different times, but they whipped off the rebels, and pursued their voyage in peace. The latter schooner had two men seriously hurt, having each lost an arm by a 12-pound shot. Lieutenant Commanding Breese gives his officers full credit for behaving handsomely under a troublesome fire from field-pieces and concealed riflemen.

"On the 21st, with a mortar-schooner alongside, I proceeded up towards the city of Vicksburg, to obtain ranges and draw the fire of the enemy's forts, about which we had no information. The rebels allowed us to get within good range, when they opened on us with all their batteries, without, however, doing any harm, and enabled us to get the desired information. I gave them four bombs, to let them see they were in range, and some 100-pound rifle-shots, and returned to the anchorage after satisfying myself about the proper position to place the mortar-vessels in.

"On June 26th, I was employed all night getting the mortars in position—nine on the right-hand side going up, under command of Lieutenant Commanding Smith, and eight on the left side, under command of Lieutenant Commanding Queen. Lieutenant Commanding Breese was left at New Orleans to bring up the last vessels. He was detained, also, getting the *Sea Foam* afloat, which vessel had grounded badly on a sand-bar, where she will most likely remain for the balance of the season. The position selected here for the mortars was a beautiful one, on the starboard side of the river, at 2500 yards from the main battery, and 2200 from the water-battery. The vessels on the port side, about 700 yards further off, were rather exposed to the enemy's fire, but were so covered up with bushes, that it was not easy to see them at that distance, much less to fire accurately at them.

"When the mortars were all in position they opened their fire deliberately, for the purpose mainly of getting ranges, which they succeeded in doing after a few fires. The enemy opened on them from all their batteries in range, but, though they fired all around and over them, none were struck. A kind Providence seems to look out for this little fleet. They soon silenced the batteries, and were enabled to pursue their experiments unmolested.

"On June 27th, the mortars opened again on the forts at 5.45 A.M., firing rapidly. The rebels attempted to respond, but were driven away from their guns after we had fired a little less than an hour. The steamers were also employed, throwing in an effective fire with their rifle-guns. The practice was kept up during the day with good effect, many of the bomb-shells going into the forts, or bursting over them. Only one vessel, the *C. P. Williams*, was struck on this day, a 7-inch shell lodging in her bow, and sticking there, showing that the enemy's powder was bad. At sunset we ceased firing, and at eight o'clock opened again with all the mortars on the town, doing much damage. At 8.30 I sent the *Owasco*, Lieutenant Commanding Guest, up abreast of the town, to throw some incendiary shells, which proved to be failures, as they did not explode.

"June 28th, at three o'clock A.M., the squadron made a move to pass the batteries, and the flotilla-steamers got under way to take their position, which was to enfilade the water-batteries as the ships passed. The headmost vessels of the squadron passed along a little before time, unsupported, and our vessels could not get near enough to them to be of any service. Five of the above-mentioned vessels went gallantly on, despite the fire of the batteries, throwing in their grape and canister, favoured much by the heavy atmosphere and early morning light. At four o'clock the flag-ship came along, with two gun-boats. By that time the mortar-steamers had got nearly into position, and moved up towards the batteries, throwing in a quick fire. Nearly all the mortars had commenced as the *Richmond* passed, and the shells were falling very well and rapidly, the *Hartford* and gun-boats opening their batteries with grape, canister, and shrapnell. The air seemed to be filled with projectiles. The lower batteries were silenced for the time, though I saw that the rebels would manage to get a shot or so at the ships after they had passed along. The batteries out of range of the mortars were very severe, and I am sorry to say that some ships lost in killed and wounded as many as they did at Forts Jackson and St. Philip. I regret that the mortars were not able to reach these batteries.

"About the time the *Hartford* passed, the *Octorora's* wheel-ropes got jammed below, and there was a fair prospect of drifting out of action, or into some of the vessels astern. As I went drifting by the *Miami*, I hailed her commander, and ordered him up within 600 yards of the batteries; also hailed the *Jackson*, and ordered the *Westfield* and *Clifton* to go ahead of me until I could relieve myself of my unpleasant position. The *Owasco*, Lieutenant Commanding Guest, and *Harriet Lane*, Lieutenant Commanding Wainwright, had been ordered to act at discretion, and throw on their fire to the best advantage, which they did effectually. The river being narrow, and the current very strong, it was impossible to manœuvre so many vessels to advantage, and leave room for the squadron of ships to pass.

"I had cleared my wheel-ropes, and succeeded in getting again to my place ahead, and was in fine position (with all the steamers firing very rapidly and effectually) to cover the *Brooklyn*, *Katahdin*, and *Kennebec*, as they came along, presuming that they were going to follow the *Hartford*. That vessel was now two miles ahead, and appeared to be under a heavy fire from a battery of six guns at the upper end of the city, out of mortar-range. The *Brooklyn* came up a little ahead of the mortar-vessels and opened fire, as did the gun-boats astern of her, but did not pass through. Not a shot had, up to this time, struck one of the mortar-steamers, when, finding it necessary to slow the engines to get out of the line of the *Brooklyn's* fire, the vessel became stationary, and a fair target for what guns the enemy were able to fire. The *Jackson*, Lieutenant Commanding Woodworth, was struck badly with rifle-shell, one of which exploded in her wheel-house, disabling the man at the wheel by cutting off his leg, and knocking her steering apparatus to pieces, which disabled her. The other struck the pillar-block support, almost cutting it in two. This steamer being disabled, the *Clifton*, Lieutenant Commanding Baldwin, went to her assistance (by signal), and while in the act of taking her in tow, a 7-inch shot passed in on the *Clifton's* port bow, going through her boiler. By this catastrophe, six of the men in and about the magazine were scalded to death, and others were scalded severely. The steam drove eight or ten men overboard, one of whom was drowned. The *Jackson*, Lieutenant Commanding Woodworth, now became the helping ship, and picked up out of the water the *Clifton's* men, that steamer being completely disabled. The *Westfield*, on approaching to assist her, was struck on the frame of her engine by a heavy rifle-shot, which, fortunately, did not go through, having struck butt-end foremost, and consequently caused but short delay. In the meantime the *Octorara* dropped out of fire, took the *Clifton* in tow, and removed her to a place of safety. The *Jackson* drifted out clear. No further necessity existing for the flotilla-steamers remaining under fire (the *Brooklyn* and those astern of her having slowed their engines, and proceeding no further), the signal was made to retire under cover of the woods, having been sixty-five minutes under fire. Although the steamers disabled were in a strong current, and narrow, crowded river, they were handled and taken out of action without confusion of any kind, beyond that occasioned by the escaping steam on board the *Clifton*. Such a calamity is always appalling to those unused to the effects of such a terrible enemy on board their own vessel. The conduct of the officers and men on board the *Clifton* was creditable in the highest degree, and I regret to say that those scalded to death were some of the leading men of the vessel.

"No further casualties occurred of any consequence. The *Jackson* and *Clifton* are temporarily repaired, the latter working under one boiler. All the steamers took good positions, and their commanders did their duty properly. It is to be regretted that a combined attack of army and navy had not been made, by which something more substantial might have been accomplished. Such an attack, I think, would have resulted in the capture of the city. Ships and mortar-vessels can keep full possession of this river, and places near the water's edge, but they cannot crawl up hills three hundred feet high, and it is that part of Vicksburg which must be taken by the army. If it was intended merely to pass the batteries at Vicksburg, and make a junction with the fleet of Flag-Officer Davis, the navy did it most gallantly and fearlessly. It was as handsome a thing as has been done during the war; for the batteries to be passed extended full three miles, with a three-knot current, against ships that could not make eight knots under the most favourable circumstances. *

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Only two schooners were struck; nobody has been hurt, so far, in the mortar-vessels.

"On the 1st of July our pickets (which were thrown out about a hundred yards) were surprised by a large body of rebels close to them, evidently intending to surprise the mortar-schooners. They immediately came in to report, the enemy firing on them as they retreated. In a moment all the guns of the mortar-vessels and flotilla-steamers opened on the woods with grape, shrapnell, canister, shell, and round shot (the mortars throwing in bombs with small charges), and we knew, if an enemy was there, he could not face a fire like ours, from fifty guns, spread out along the levee for about a mile. After the woods were well shelled, the pickets went in and captured three rebel soldiers, who were helplessly stuck in the mud, from which they had much difficulty in extricating themselves, and cried lustily that they had surrendered. They were brought in, with their arms and accoutrements. These men state that two regiments, one from Tennessee, the other from Mississippi, were put under arms, and made to believe they were going to attack some United States' troops. Finding the head of our schooners guarded, the rebels attempted to pass through the middle of the wood and enfilade us, but got helplessly stuck in the middle of the swamp, or the thick mud which exists here. While in this condition, our guns commenced shelling the woods. * * * * *

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It was on this marsh I depended for safety, when I placed the schooners in position; for without such a natural defence, we should have been at the mercy of concealed riflemen.

"Not wishing to have any mishaps, I landed five howitzers, threw up works, posted fifty marines as pickets, and had a large bell slung up in the woods, with lines leading to it from different points, so that the pickets might give immediate alarm. After which the mortar-flotilla went to their repose with great confidence. We have held the position we first took. We have advanced, indeed, 300 yards with the mortars. We are within 2100 yards of the enemy's batteries, and in short distance of an army which (they say) consists of thirty thousand men—a very doubtful estimate, as it will not amount to a half or a third of that number. From what I can learn from pretty reliable sources, the regiments are small, and do not average five hundred men each. I do not think there are six thousand men in this town and the surrounding country, and many of them are sick.

"I respectfully submit a list of the killed and wounded on board the steamers *Clifton* and *J. P. Jackson.* * *

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"On the 2nd of July the enemy made another attack on our pickets and drove them in, wounding two of them, and succeeded in getting so close as to fire on our decks; but they soon met with the fire of five field-pieces which I had placed near the edge of the woods, and which must have inflicted severe punishment. Five dead bodies have since been found, and evidences of some wounded, from the muskets and other arms thrown away, I suppose in the retreat. Since then we have fortified ourselves so that they cannot annoy us without getting the worst of it. They have shelled our position, fired hot shot and rifled shot in abundance; and though they have made some holes in the mortar-vessels, we have held our position, and shell them out whenever we open on them with mortars.

"Very respectfully, your obedient servant,

"David D. Porter,
"Commanding Mortar-Flotilla.

"Flag-Officer D. G. Farragut,
"Commanding Western Gulf Squadron,
"United States' Steamer *Hartford*."

3.—*Passing of the Batteries at Island No.* 10 *by the Federal Gun-boats Carondelet and Pittsburg.*

The position of Island No. 10 has already been described in the third chapter. Finding it of vital importance to the capture of the place that a gun-boat should be at New Madrid for the purpose of covering General Pope's army (which had reached that point already several days ago), while he was crossing the Mississippi to the Tennessee side, Flag-Officer A. H. Foote, commanding the Federal flotilla above Island No. 10, ordered Commander H. Walke, Commanding *Carondelet*, to avail himself of the first fog or rainy night, to drift his steamer down past the batteries on the Tennessee shore and Island No. 10.

This order was successfully executed in the hour from ten to eleven o'clock of the night of April 4th, 1862, during a heavy thunderstorm, which rendered it almost impossible to recognize any object at a distance of ten yards. The Confederate artillerymen were promptly in their batteries, nearly blinded by the wind and rain beating in their faces; but as the *Carondelet* had screened her fires, and put out all lights, and did not fire a single gun at the batteries, her position could be merely guessed at by the rapid flashes of lightning illuminating the dark and boisterous night. Forty-seven heavy guns did their utmost to prevent the steamer from passing, yet she escaped without having received a single shot.

As it was thought by the Confederate artillery officers that the vessel had protected herself by fastening to her port side a barge loaded with hay, they kept for future occasions stands of grape, heated red-hot, near the batteries, believing that by the scattering of the grape, they might be able to lodge a few shot in the hay or cotton loaded on a barge thus employed, causing it to ignite.

The successfully executed feat of the *Carondelet* had again proved the impossibility in the night to fire with any kind of certainty heavy guns, especially at a moving object. Some of the shots fired at the *Carondelet* had passed 200 feet above her.

Not less fortunate than the *Carondelet* was the gun-boat *Pittsburg*, which, at two o'clock on the morning of April 8th, in a heavy thunderstorm, ran the blockade of the same batteries, equally without being struck once, although the random fire of fifty-four guns had been concentrated on her.

Considering that the channel of the river leads to within 300 yards of the head of the island, on which a very heavy battery had been established, which was commanded by a vigilant, experienced, and gallant officer (Captain, afterwards Brigadier-General Hume), the passages of the two vessels certainly present remarkable features.

4.—*Passage of Port Hudson.*

Port Hudson is situated below Vicksburg, on the left bank of the Mississippi River. The high bluff, on which the small place is built, had invited to the establishment of a few batteries, that, after the fall of Columbus, Island No. 10, and Fort Pillow, growing in importance, had gradually been extended, till they formed a system of works by far superior to the batteries and works at Vicksburg. The river is here one mile wide.

(*a*.) GENERAL ORDER FOR PASSING PORT HUDSON, MISSISSIPPI.

"UNITED STATES' FLAG-SHIP *Hartford*, 1863.

"THE ships will each take a gun-boat on her port side, and secure her as well aft as possible, so as to leave the port battery clear for the enemy's battery on the port side of the river going up, after we round the point opposite Port Hudson.

"Each ship will keep a very little on the starboard quarter of her next ahead, so as to give free range to her chase guns, without risk of damage from premature explosion of shrapnell or shell.

"The captains will bear in mind that the object is to run the batteries at the least possible damage to our ships, and thereby secure an efficient force above for the purpose of rendering such assistance as may be required of us by the army at Vicksburg, or, if not required there, to our army at Baton Rouge. If they succeed in getting past the batteries, the gun-boats will proceed up to the mouth of Red River, and keep up police of the river-batteries between that river and Port Hudson, capturing everything they can.

"Should any vessel be disabled, so that she is unable to pass Port Hudson, she will use the gun-boat to the best advantage. If the captain thinks he can get by, try it; if he thinks not, let the gun-boat drop her down below the range of the batteries. If both are disabled, then club down with a light anchor, or use the sails, as in his judgment may seem best, but I expect all to go by who are able; and I think the best protection against the enemy's fire is a well-directed fire from our own guns, shell, and shrapnell at a distance, and grape when within 400 or 500 yards.

"D. G. FARRAGUT.
"Rear-Admiral."

(*b*.) REPORT OF REAR-ADMIRAL D. G. FARRAGUT.

"FLAG-SHIP *Hartford*,
"Off Mouth of Red River, March 16th, 1863.

"SIR,—It becomes my duty again to report disasters to my fleet, although I know neither the extent nor the attendant circumstances; I shall, therefore, confine my report to those facts which came under my own personal observation.

"On the morning of the 13th instant, off Baton Rouge, I inspected the ships of my command to see that all the proper arrangements had been made for battle, &c., and I am happy to say found everything well arranged, and the ships well prepared in every respect. My general order had been previously written, and delivered to each commanding officer for his guidance in passing Port Hudson. I had had a consultation with General Banks in the morning, and he informed me that he was ready to move against Port Hudson immediately, and make a diversion in my favour, and attack the place if he found it practicable, &c. At 4 P.M., I signalized to the fleet to get under way, and we proceeded up the river to near Profit's Island. Early the next morning (14th), we proceeded on up to the head of Profit's Island, where we found the *Essex* and the mortar-boats all lying ready for their work. I called all the commanders on board of this ship, and consulted Commander Caldwell as to the batteries, his information connected with the place, and the character of the steamers we saw above (they were five in number, two cotton rams for boarding our gun-boats, and the others river steamers, transports, &c.). I also directed the mortar-boats to commence firing, in order to get their ranges, which they did; but finding the distance too great, I directed them to move half-a-mile nearer. We conversed freely as to the arrangements, and I found that all my instructions were well understood, and, I believe, concurred in by all. The gun-boats were assigned to the ships according to their speed, giving the *Richmond*—she being the slowest ship—the

Genesee, she being the most powerful and fastest gun-boat. After a free interchange of opinions on the subject, every commander arranged his ship in accordance with his own ideas. I had directed a trumpet, fixed from the mizzen-top to the wheel, on board of this ship, as I intended the pilot to take his station in the top, so that he might see over the fog or smoke, as the case might be. To this idea, and to the coolness and courage of my pilot, Mr. Correll, I am indebted for the safe passage of this ship past the forts. At 5 P.M. (14th), I received a despatch from General Banks, announcing that his command was at the Cross-roads, and all ready to move upon Port Hudson. In reply I informed him that I hoped to have passed at midnight. At dusk I made signal to the gun-boats to take the stations assigned to them. At 9 P.M., I made signal for the fleet 'to weigh,' but from some cause or the other the *Mississippi* and *Monongahela* did not come up to their stations, although they answered the signal. A 10 P.M., the tug *Reliance* came alongside, and I sent her to order them to 'close up,' and as soon as I could see the vessels in position we went ahead. My instructions to Commander Caldwell were not to open fire until the enemy opened upon us. I think we took them by surprise somewhat, as they did not open fire upon us until we were abreast of a large light placed on the opposite side to guide their fire there. The look-out threw up rockets, and a battery soon opened on us at about 11.20 P.M., but did not answer our broadside. Commander Caldwell, of the *Essex*, now opened in fine style, and the mortar-boats did their duty in the most handsome manner, keeping up their fire until two or three o'clock in the morning. This ship moved up the river in good style, Captain Palmer governing, with excellent judgment, her fire according to circumstances, stopping when the smoke became too dense to see, and re-opening whenever a fresh battery opened upon us; but we always silenced their battery when we fired. At last, the current from around the point took us on the bow and threw us around, almost on shore; but backing the *Albatross*, and going ahead strong on this ship, we at length headed her up the river. The upper batteries now opened on us, and we could only reply with the two guns on the poop—a 9-inch and a 30-pounder Parrott rifle—but they both did their duty well. When we rounded the bend, I saw the *Richmond*, as indeed I had done whenever during the action the smoke was not too dense, and I thought that she was following us in fine style, as I could see the effect of each of her broadsides upon the batteries. Great, however, was my surprise when I found that she did not come up after we had rounded the point, but my fears were not excited until sufficient time had elapsed for the other vessels to join us.

"I soon saw a vessel on fire, and apparently grounded, and I feared she was one of ours. I next saw her drifting down the river, with her guns going off and the shells exploding from the heat. We now arrived at the conclusion that one or more of the vessels had met with disaster, and the rest had dropped down the river again. The fire ceased about this time (2 A.M.), and near 4 A.M. (15th), the burning vessel blew up with great explosion.

"The nature and details of this disaster will doubtless be communicated to you by the senior surviving officer below Port Hudson, in command of the fleet.

"In conclusion, I can only say that I know not how far I am responsible for this sad affair, but I take it for granted that as the flag-ship came safely through, and saw the others following, the disaster must have been caused by an accidental shot disabling a vessel, and the others stopped to assist her instead of coming through and letting one of the gun-boats take her down. But I have too high an estimation of *each* and of *every* one of the officers commanding those vessels, to imagine, for a single instant, that everything in their power was not done to ensure success. The only fear I had was getting aground in rounding the bend.

"I assigned no gun-boat to the *Mississippi* for two reasons:

first, I had but three gun-boats; second, she being a side-wheel steamer, would not take one alongside to advantage, and, in fact, with the exception of the assistance they might have rendered the ships if disabled, they were a great disadvantage.

" If in this effort to come up and cut off the enemy's supplies from Red River and recapture the *Indianola*, misfortune has befallen some of our vessels, I can only plead my zeal to serve my country and the chances of war; and I felt that my orders of October 2nd, 1862, fully justified me in doing what I should have done two months ago but for the disasters at Galveston and Sabine Pass, the strong force of the enemy at Mobile, and the inadequacy of my force to meet all these contingencies.

" I therefore have the satisfaction of knowing that I acted to the best of my judgment, and hence am only answerable for the imperfection of that judgment.

* * * * * * *

" I have the honour to be,
" Very respectfully, your obedient servant,
" D. G. FARRAGUT,
" Rear-Admiral Commanding W.G.S.

" HON. GIDEON WELLES,
" Secretary of the Navy, Washington, D.C."

(*c*.) REPORT OF LIEUTENANT-COMMANDER JOHN WALTERS, COMMANDING UNITED STATES' STEAMER *Kineo*.

" UNITED STATES' STEAMER *Kineo*,
" Below Port Hudson, March 15th, 1863.

" SIR,—I have the honour to make the following report of the part this vessel played in the action of last night:—

" As we advanced steadily up the river, in the position assigned by the general sailing order, secured to the port side of the United States' steamer *Monongahela* for the purpose of mutual support, we were unable to join in the action until 10.30 P.M. When abreast the lowest battery, with which our consort was engaged, we received fire of musketry from the opposite bank, which was replied to immediately with two-second shrapnell and grape, silencing them quickly. In this manner we continued steadily on, our consort keeping up a brisk fire upon the enemy's batteries, whose fire we were receiving, and we watching for a renewal of the musketry from the west bank. An hour later, when under the principal batteries, and getting along very well, although the atmosphere was greatly obscured by the smoke of our guns, and it was difficult to see we had kept the channel and had reached the bend of the river, our fore-gaff was shot away, and a few seconds afterwards a shot lodged in our rudder-post, splitting it, and rendering the rudder useless. Endeavoured to work it with relieving tackles and rudder-chains, but found it could not be moved to the right or left. Sent a man over the stern in a bow-line to examine the damage, and found the shot firmly embedded between the rudder-post and the stern-post, thereby wedging it completely, and rendering it unserviceable.

"At this time we were receiving the heaviest fire of the enemy's batteries, who generally fired over, and our consort being damaged also in the rudder, was unable to keep the channel, and the two vessels were driven ashore by the current, which was very strong, and thrown on Thompson's Point, going full speed. The *Monongahela*, being deeper draught, grounded first, and stopped with a great shock. Stopped the engines and reversed quickly, but our momentum was so great the fasts between the two vessels were all torn away except one hawser. Our fore-channels and rigging were swept off, our lower anchor thrown in on deck, the hammock-netting torn away, and several stanchions. We drove about a ship's length ahead, and grounded within ten feet of the bank. The engines being reversed, we succeeded in getting off. Backed down to the *Monongahela* to render assistance which was asked for, she being still hard aground, and receiving a terrific fire. Astern of her the *Mississippi* was also ashore

"It is proper to state at this time that our pilot was on board the *Monongahela*, where he had been assisting the other pilot, by order of Captain McKinstry, of the *Monongahela;* and here we were separated without a pilot, and the ship disabled seriously. Had great difficulty in working the ship in the current, so as to get near the *Monongahela*, which we could only do by alternating the motions of the engines, but could not get near enough to receive her hawsers in consequence of the current cutting us off. Then resolved to go ahead, and try to spring her off with the hawser we had, in which we were successful, and her bow swung off into deep water. Seeing which, and being unable to render further assistance, cast-off and dropped this ship by the current past the batteries under a severe fire, most of which passed over us, which was very remarkable, because the burning ship *Mississippi* enabled them to see us plainly. Under these circumstances, the first thought was to save the ship; and knowing we could do them little damage with our light battery, suspended fire, and dropped down out of their range.

* * * * * * *

"Very respectfully, your obedient servant,

"JOHN WALTERS,
"Lieutenant-Commander, U.S.N.

"CAPTAIN J. P. M'KINSTRY, U.S.N.,
"Commanding U.S. Steamer *Monongahela*, Senior Officer."

(*d.*) REPORT OF COMMANDER C. H. B. CALDWELL, COMMANDING UNITED STATES' STEAMER *Essex*.

"UNITED STATES' IRON-CLAD *Essex*,
"Below Port Hudson, Mississippi River, March 15th, 1863.

SIR,—I have respectfully to report that as the flag-ship *Hartford* passed this vessel, we got under way, and, leaving the mortar-vessels, proceeded up the river some distance, and took up a position to enfilade the lower batteries.

"At 11 o'clock, the enemy fired the first gun on the *Hartford*, and this being the signal for them to open fire, it was continued by them and this vessel without intermission till 1.30, the vessels throwing a total of 296 shells, including 90 from this vessel.

"The effect of the fire of the mortar-vessels seemed to paralyze the efforts of the enemy at the lower batteries, and we observed that their fire was quite feeble, compared to that of the upper batteries.

"About 10 o'clock, a boat from the *Mississippi* came alongside with wounded men, and reported their vessel ashore, and that a large number of the men were on the opposite bank. We crossed the river immediately, and took a number on board. The *Mississippi* had been observed on fire for some time. She was now coming down quite fast in flames, and close in to the west bank. I was obliged to recross the river to get out of her way, fearing an explosion from her magazine at any moment. As she passed the mortar-boats, the guns of her port battery were discharged, owing to the heat, throwing the shells over the vessels, but fortunately doing no damage.

"After she passed down, we crossed the river again, and took on board all the remainder of the crew that were there, making in all received on board about sixty officers and men.

"Very respectfully, your obedient servant,

"C. H. B. CALDWELL, Com., U.S.N.,
"Commanding Mortar-Flotilla, Mississippi River.

"JAMES ALDEN, U.S.N., Commander,
"Commanding U.S. Naval Forces, below Port Hudson."

5.—*Confederate Gun-boats running the gauntlet of Federal Batteries established on the right bank of the Mississippi River below Tiptonville.*

As previously mentioned, the Federals, even before the fall of Island No. 10, occupied with a strong force the right (Missouri) bank of the Mississippi River for several miles below Tiptonville. The distance from this point to Island No. 10, across the peninsula, which is here formed by the river, is only six miles, whilst the distance by water is fully thirty-two miles. For this reason, communication between the island and the points on the river below, was, after the enemy had taken possession of New Madrid, effected by land to Tiptonville, and thence by water. In order to cut off this communication, the Federals established below Tiptonville, on the Missouri side, five additional batteries, scattered over a distance of five miles. These batteries had to be passed twice, almost nightly, by one or another of the Confederate gun-boats, stationed under command of Commodore Hollins a few miles below Fort Pillow. The Federals, fully aware of the importance attached by the Confederates to the keeping open of their communication, were always on the *qui vive* in their batteries, and had the advantage of knowing that at some hour of the night a Confederate gun-boat would attempt her passage. For the three weeks during which this state of affairs continued, hardly a single night, bright moonlight nights not even excepted, passed, without a Confederate steamer attempting the daring feat of running by the Federal batteries. These vessels had been remodelled from ordinary Mississippi river-boats into men-of-war, and in strength could not compare with the least of the Federal gun-boats; they all were side-wheel steamers, carrying their boilers and machinery on deck; neither was their steering-apparatus or their magazine sufficiently protected; and yet the blockade of the river, here hardly one mile wide, was successfully run at least thirty times in twenty-one nights.

6.—(*a.*) *Confederate ram Arkansas passing the Federal fleet above Vicksburg.*

After the fall of Nashville and New Orleans, the Confederates had established new navy-yards in the south-west, at points not easily accessible to the enemy. Selma, on the Alabama River; Oven Bluff, on the Tombigbee; and Yazoo city, on the Yazoo, numbered among this class. At the latter point, an iron-clad, the *Arkansas*, had been built under direction of Captain Isaac N. Brown, of the Confederate States' navy. The great defect of this, as of most Confederate steamers, lay in the machinery and steering-apparatus. However, when completed, her daring commander ran her down the Yazoo River, driving before her the Federal iron-clads sent up that stream for the purpose of capturing her, passed through the midst of Admiral Farragut's fleet above Vicksburg, and reached this point not materially injured by the furious fire concentrated on her. She was afterwards, August 6th, 1862, attacked below Baton Rouge by seven Federal gunboats, among them the iron-clad *Essex*, by the fire of which the machinery and the steering-apparatus of the ram was disabled, so as to render her unmanageable. She continued, however, firing her guns at the *Essex*, but, presenting a weak point to this vessel, she was fired into with incendiary shells, set on fire, and blown up.

The first engagement with the *Arkansas* is thus described by Rear-Admiral Farragut:—

"UNITED STATES' FLAG-SHIP *Hartford*,
"Below Vicksburg, July 17th, 1862.

"SIR,—It is with deep mortification that I announce to the Department that, notwithstanding my prediction to the contrary, the iron-clad ram *Arkansas* has at length made her appearance, and taken us all by surprise. We had heard that she was up at Liverpool, in the Yazoo River, and Lieutenant-Colonel Ellet informed me that the river was too narrow for our gun-boats to turn, and was also shallow in places, but suggested that Flag-Officer Davis might send up some of his iron-clads, which draw only six or seven feet of water.

"When this was proposed to Flag-Officer Davis he consented immediately, and General Williams offered to send up a few sharpshooters. The next morning they went off at daylight, and by six in the morning we heard firing up the river, but supposed it to be the gun-boats firing at the flying artillery said to be lining the river. In a short time, however, the gun-boats appeared, and the ram in pursuit. Although we were all lying with low fires, none of us had steam, or could get it up in time to pursue her; but she took the broadside of the whole fleet. It was a bold thing; and she was only able to drift, or go at the slowest speed, say, one knot; and with the current she got down to the forts of Vicksburg before any of us had steam up.

"I had a consultation with Flag-Officer Davis, and we thought it best to take the evening, when he dropped down to take the fire of the upper battery, and my squadron passed down with the determination of destroying the ram, if possible; but by delays of getting in position, &c., it was so dark by the time we reached the town, that nothing could be seen except the flashes of the guns; so that, to my great mortification, I was obliged to go down and anchor, with the rest of my fleet, to protect the transports, mortar-boats, &c.

"The ram is now repairing damages; for we put many holes through her, though we do not know the extent of damage done to her. I regret to report that the loss from this vessel was one officer and two men killed, and five men wounded. The total loss in the fleet was five killed, and sixteen wounded. I enclose herewith the fleet-surgeon's report of casualties.

"Very respectfully, your obedient servant,

"D. G. FARRAGUT, Flag-Officer,
"Commanding Western Gulf Blockading Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington, D.C."

Thus, the Federal fleet passed the batteries of Vicksburg for a second time, without sustaining any serious loss.

(*b*.) The running of the blockade of the ports of Charleston, Wilmington, Savannah, Mobile, and Galveston might equally furnish proofs of the impossibility, under all circumstances, to prevent by artillery-fire alone, a steamer from forcing a passage, the channel of which has remained free of obstructions. For instance, many of the vessels which broke the blockade at Mobile had high-pressure engines, and had from ordinary river-boats been changed into sea-going crafts. Although, in several instances, hotly chased by the Federal blockaders, a number of them succeeded in reaching their destined port. The English-built blockade-runner *Denbigh* was, in her voyages, almost as regular as a mail-packet in time of peace.

CHAPTER VI.

V.—*A merely partial Obstruction of the Channel not sufficient to enable Forts to keep out a large Fleet.*

In the preceding chapter it has been shown how successfully a steam-fleet, under a daring and determined commander, may pass any forts and shore batteries, if the channel is free of obstructions. From the description of the passing of Admiral Farragut's fleet by Fort Morgan, on August 5th, 1864, it will be seen how utterly insufficient an only partial obstruction of the channel is to prevent vessels forcing a passage.

The general position of the Confederate defences in the lower Bay of Mobile has already been indicated in a preceding chapter. Fig. 1 of Plate I. will serve to give a correct idea of the Federal attack of August 5th, 1864. The line of piles, extending from the head of the eastern bank to the edge of the tortuous and shallow channel near Fort Gaine, rendered it impossible for any vessel to pass between the bank and the channel; besides, only vessels of very light draught could have made such an attempt. But the channel between Mobile Point and the eastern bank has a depth reaching at some places as much as 65 feet; the bottom is bad, drift-sand; and the action of ebb and flood and of the wind is very strong. Under such circumstances, an obstruction of this channel would, even in time of peace, be an undertaking taxing not only the full ingenuity of a competent engineer, but also requiring an expenditure of material, time and labour which were not at the disposal of the engineer officers occupying at different periods the position of Chief Engineer of the Department of the Gulf of Mexico. Not able to carry out any of the several plans that suggested themselves for the obstruction of this important channel, the then Chief Engineer of the Department had to have recourse to torpedoes alone (see Part II. of this treatise); but even here met with a difficulty, that presented itself in form of an order from the Department-Commander to leave a gap in the line of torpedoes, through which blockade-runners could pass without danger. Thus, a gap of over 500 yards was left between Mobile Point and the buoy marking the eastern end of the three lines of torpedoes; a circumstance which, doubtless, facilitated the accomplishment of Admiral Farragut's bold plan, although had the gap been closed by torpedoes alone, we have our very serious doubts if it would have made any material difference. And, though this subject will be more fully treated on in a following chapter, the remark that torpedoes alone are no sufficient obstruction of a channel may not come amiss here.

Admiral Farragut's fleet, with which he passed the heavy batteries of Fort Morgan, consisted of four iron-clads and fourteen steamers. Not a single one of the guns in the Confederate batteries was silenced by the torrent of shrapnell, shell, and grape poured into them as each Federal vessel passed. Admiral Buchanan's little squadron—iron-clad *Tennessee*, Captain Johnston; wooden gun-boats *Morgan*, Captain Bennett; *Selma*, Captain Murphy; and *Gaines*, Captain Harris—made a most heroic resistance. The channel had been partially obstructed, and not without all results;* and yet the Federal fleet forced a passage, and the lower Bay of Mobile was lost to the Confederates.

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* The Monitor *Tecumseh* was sunk by a torpedo (see page 121).

(*a*.) GENERAL ORDERS OF REAR-ADMIRAL FARRAGUT.

[General Order No. 10.]

"UNITED STATES' FLAG-SHIP *Hartford*,
"Off Mobile Bay, July 12th, 1864.

"STRIP your vessels and prepare for the conflict. Send down all your superfluous spars and rigging. Trice up or remove the whiskers. Put up the splinter-nets on the starboard side, and barricade the wheel and steersman with sails and hammocks. Lay chains or sand-bags on the deck over the machinery, to resist a plunging fire. Hang the sheet-chains over the side, or make any other arrangement for security that your ingenuity may suggest. Land your starboard boats, or lower and tow them on the port side, and lower the port boats down to the water's edge. Place a leadsman and the pilot in the port-quarter boat, or the one most convenient to the commander.

"The vessels will run past the forts in couples, lashed side by side, as hereinafter designated. The flag-ship will lead and steer from Sand Island N. by E. by compass, until abreast of Fort Morgan; then N.W. half N. until past the Middle Ground; then N. by W., and the others, as designated in the drawing, will follow in due order until ordered to anchor; but the bow and quarter line must be preserved, to give the chase-guns a fair range; and each vessel must be kept astern of the broadside of the next ahead. Each vessel will keep a very little on the starboard quarter of his next ahead, and when abreast of the fort, will keep directly astern, and as we pass the fort will take the same distance on the port-quarter of his next ahead, to enable the stern-guns to fire clear of the next vessel astern.

"It will be the object of the Admiral to get as close to the fort as possible before opening fire; the ship, however, will open fire the moment the enemy opens upon us, with their chase and other guns, as fast as they can be brought to bear.

Use short fuzes for the shell and shrapnell, and as soon as within 300 or 400 yards, give the grape. It is understood that heretofore we have fired too high; but with grape-shot it is necessary to elevate a little above the object, as grape will dribble from the muzzle of the gun. If one or more of the vessels be disabled, their partners must carry them through, if possible; but as the Admiral contemplates moving with the flood tide, it will only require sufficient power to keep the crippled vessels in the channel. Vessels that can, must place guns upon the poop and topgallant forecastle, and in the tops on the starboard side. Should the enemy fire grape, they will remove the men from the topgallant forecastle and poop to the guns below until out of grape range.

"The howitzers must keep up a constant fire from the time they can reach with shrapnell until out of its range.

"D. G. Farragut,
"Rear-Admiral, Commanding W.G.B. Squadron."

(*h.*) [General Order No. 11.]

"Flag-ship *Hartford*,
"Mobile Bay, July 29th, 1867.

"Should any vessel be disabled to such a degree that her consort is unable to keep her in her station, she will drop out of line to the westward, and not embarrass the vessel next astern by attempting to regain her station. Should she repair damages so as to be able to re-enter the line of battle, she will take her station in the rear as close to the last vessel as possible. So soon as the vessels have passed the fort, kept away north-west, they can cast off the gun-boats at the direction of the senior officer of the two vessels, and allow them to proceed up the bay to cut off the enemy's gun-boats that may be attempting to escape up to Mobile. There are certain black buoys placed by the enemy from the piles on the west side of the channel across it towards Fort Morgan. It being understood that there are torpedoes and other obstructions between the buoys, the vessels will take care to pass eastward of the easternmost buoy, which is clear of all obstructions. So soon as the vessels arrive opposite the end of the piles, it will be best to stop the propeller of the ship, and let her drift the distance past by her headway and the tide; and those having side-wheel gun-boats will continue on by the aid of their paddle-wheels, which are not likely to foul with the enemy's drag-ropes.

"D. G. FARRAGUT,
"Rear-Admiral."

(c.) DETAILED REPORT OF REAR-ADMIRAL D. G. FARRAGUT.

"UNITED STATES' FLAG-SHIP *Hartford*,
"Mobile Bay, August 12th, 1864.

"SIR,— * * * * * *

"Notwithstanding the loss of life, particularly in this ship, and the terrible disaster to the *Tecumseh*, the result of the fight was a glorious victory, and I have reason to feel proud of the officers, seamen, and marines of the squadron under my command, for it has never fallen to the lot of an officer to be thus situated and thus sustained. Regular discipline will bring men to any amount of endurance, but there is a natural fear of hidden dangers, particularly when so awfully destructive of human life as the torpedo, which requires more than discipline to overcome.

"Preliminary to a report of the action of the 5th, I desire to call the attention of the Department to the previous steps taken in consultation with Generals Canby and Granger. On the 8th of July I had an interview with these officers on board the *Hartford* on the subject of an attack on Forts Morgan and Gaines, at which it was agreed that General Canby would send all the troops he could spare to co-operate with the fleet. Circumstances soon obliged General Canby to inform me that he could not despatch a sufficient number to invest both forts, and in reply I suggested that Gaines should be the first invested, engaging to have a force in the sound, ready to protect the landing of the army on Dauphine Island, in the rear of that fort, and I assigned Lieutenant-Commander De Krafft, of the *Conernaugh*, to that duty.

"On the 1st instant, General Granger visited me again on the *Hartford*. In the mean time the *Tecumseh* had arrived at Pensacola, and Captain Craven had informed me that he would be ready in four days for any service. We therefore fixed upon the 4th of August as the day for the landing of the troops and my entrance into the bay; but owing to delays mentioned in Captain Jenkins' communication to me, the *Tecumseh* was not ready. General Granger, however, to my mortification, was up to time, and the troops actually landed on Dauphine Island. As subsequent events proved, the delay turned to our advantage, as the rebels were busily engaged during the 4th in throwing troops and supplies into Fort Gaines, all of which were captured a few days afterwards.

"The *Tecumseh* arrived on the evening of the 4th, and everything being propitious, I proceeded to the attack on the following morning.

"As mentioned in my previous despatch, the vessels outside the bar, which were designed to participate in the engagement, were all under way by forty minutes past five in the morning in the following order, two abreast and lashed together:—*Brooklyn*, Captain James Alden, with the *Octorara*, Lieutenant-Commander C. H. Green, on the port side Captain Percival Drayton, with the *Metacomet*, Lieutenant-Commander J. E. Jewett; *Richmond*, Captain T. A. Jenkins, with the *Port Royal*, Lieutenant-Commander B. Gherardi; *Lackawanna*, Captain J. B. Marchand, with the *Seminole*, Commander E. Donaldson; *Monongahela*, Commander J. H. Strong, with the *Kennebec*, Lieutenant-Commander W. P. McCann; *Ossipee*, Commander W. E. Le Roy, with the *Itasca*, Lieutenant-Commander George Brown; *Oneida*, Commander J. R. Mullany, with the *Galena*, Lieutenant-Commander C. H. Wells. The iron-clads *Tecumseh*, Commander T. A. M. Cravan; the *Manhattan*, Commander J. W. A. Nicholson; the *Winnebago*, Commander T. H. Stephens, and the *Chickasaw*, Lieutenant-Commander G. H. Perkins—were already inside the bar, and had been ordered to take up their positions on the starboard side of the wooden ships, or between them and Fort Morgan, for the double purpose of keeping down the fire from the water-battery and the parapet guns of the fort, as well as to attack the ram *Tennessee* as soon as the fort was passed.

"It was only at the urgent request of the captains and commanding officers that I yielded to the *Brooklyn* being the leading ship of the line, as she had four chase-guns and an ingenious arrangement for picking up torpedoes, and because, in their judgment, the flag-ship ought not to be too much exposed. This I believe to be an error; for, apart from the fact that exposure is one of the penalties of rank in the navy, it will always be the aim of the enemy to sink the flag-ship; and, as will appear in the sequel, such attempt was very persistently made, but Providence did not permit it to be successful.

"The attacking fleet steamed steadily up the main ship-channel, the *Tecumseh* firing the first shot at forty-seven minutes past six o'clock. At six minutes past seven the fort opened upon us, and was replied to by a gun from the *Brooklyn*, and immediately afterward the action became general.

"It was soon apparent that there was some difficulty ahead. The *Brooklyn*, for some cause which I did not then clearly understand, but which has since been explained by Captain Alden in his report, arrested the advance of the whole fleet, while at the same time the guns of the fort were playing with great effect upon that vessel and the *Hartford*. A moment after, I saw the *Tecumseh*, struck by a torpedo, disappear almost instantaneously beneath the waves, carrying with her her gallant commander and nearly all her crew. I determined at once, as I had originally intended, to take the lead; and, after ordering the *Metacomet* to send a boat to save, if possible, any of the perishing crew, I dashed ahead with the *Hartford*, and the ships followed on, their officers believing that they were going to a noble death with their commander-in-chief. I steamed through between the buoys, where the torpedoes were supposed to have been sunk. These buoys had been previously examined by my flag-lieutenant, J. Crittenden Watson, in several nightly reconnoissances. Though he had not been able to discover the sunken torpedoes, yet we had been assured by refugees, deserters, and others of their existence, but believing that, from their having been some time in the water, they were probably innocuous, I determined to take the chance of their explosion.

"From the moment I turned to the north-westward, to the clear middle ground, we were enabled to keep such a broadside fire upon the batteries of Fort Morgan that their guns did us comparatively little injury.

"Just after we passed the fort, which was about ten minutes before eight o'clock, the ram *Tennessee* dashed out at this ship, as had been expected, and in anticipation of which I had ordered the Monitors on our starboard side. I took no further notice of her than to return her fire. The rebel gunboats *Morgan* and *Selma* were ahead, and the latter particularly annoyed us with a raking fire, which our guns could not return. At two minutes after eight o'clock I ordered the *Metacomet* to cast off, and go in pursuit of the *Selma*. Captain Jewett was after her in a moment, and in an hour's time he had her as a prize. She was commanded by P. V. Murphy, formerly of the United States' navy. He was wounded in the wrist; his executive officer, Lieutenant Comstock, and eight of the crew killed, and seven or eight wounded. Lieutenant-Commander Jewett's conduct during the whole affair commands my warmest commendations. The *Morgan* and *Gaines* succeeded in escaping, under the protection of the guns of Fort Morgan, which would have been prevented had the other gun-boats been as prompt in their movements as the *Metacomet;* the want of pilots, however, I believe, was the only difficulty. The *Gaines* was so injured by our fire that she had to be run ashore, where she was subsequently destroyed, but the *Morgan* escaped to Mobile during the night, though she was chased and fired upon by our cruisers.

"Having passed the forts, and dispersed the enemy's gun-boats, I had ordered most of the vessels to anchor, when I perceived the ram *Tennessee* standing up for this ship. This was at forty-five minutes past eight. The Monitors, and such of the wooden vessels as I thought best adapted for the purpose, were immediately ordered to attack the ram, not only with their guns, but bows on at full speed, and then began one of the fiercest naval combats on record.

"The *Monongahela,* Commander Strong, was the first vessel that struck her, and in doing so carried away her own iron prow, together with the cutwater, without apparently doing her adversary much injury. The *Lackawanna,* Captain Marchand, was the next vessel to strike her, which she did at full speed; but though her stem was cut and crushed to the plank-ends for the distance of three feet above the water's edge to five feet below, the only perceptible effect on the ram was to give her a heavy list.

"The *Hartford* was the third vessel which struck her, but, as the *Tennessee* quickly shifted her helm, the blow was a glancing one, and, as she rasped along our side, we poured our whole broadside of 9-inch solid shot within ten feet of her casement. The Monitors worked slowly, but delivered their fire as opportunity offered. The *Chickasaw* succeeded in getting under her stern, and a 15-inch shot from the *Manhattan* broke through her iron plating and heavy wooden backing, though the missile itself did not enter the vessel.

"Immediately after the collision with the flag-ship, I directed Captain Drayton to bear down for the ram again. He was doing so at full speed, when, unfortunately, the

Lackawanna ran into the *Hartford* just forward of the mizen-mast, cutting her down to within two feet of the water's edge. We soon got clear again, however, and were fast approaching our adversary, when she struck her colours, and run up the white flag.

"She was at this time sore beset; the *Chickasaw* was pounding away at her stern, the *Ossipee* was approaching her at full speed, and the *Monongahela*, *Lackawanna*, and this ship were bearing down upon her, determined upon her destruction. Her smoke-stack had been shot away, her steering-chains were gone, compelling a resort to her relieving tackles, and several of her port shutters were jammed. Indeed, from the time the *Hartford* struck her until her surrender, she never fired a gun. As the *Ossipee*, Commander Le Roy, was about to strike her, she hoisted the white flag, and that vessel immediately stopped her engine, though not in time to avoid a glancing blow.

"During the contest with the rebel gun-boats and the ram *Tennessee*, and which terminated by her surrender at ten o'clock, we lost many more men than from the fire of the batteries of Fort Morgan. Admiral Buchanan* was wounded in the leg; two or three of his men were killed, and five or six wounded. Commander Johnston, formerly of the United States' navy, was in command of the *Tennessee*, and came on board the flag-ship to surrender his sword, and that of Admiral Buchanan.

* * * * * * *

"Our iron-clads, from their slow speed and bad steering, had some difficulty in getting into and maintaining their position in line as we passed the fort, and in the subsequent encounter with the *Tennessee*, from the same causes, were not as effective as could have been desired.

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* Admiral James Buchanan, by his daring bravery, had greatly endeared himself to the people of the South. Remaining alone during this conflict, standing on the casemate of the *Tennessee*, he was severely wounded in his left leg, but would not give up the unequal conflict, till, the steering-apparatus of his vessel having been injured, the ram had become unmanageable, and, the smoke-stack having fallen, the casemate was so filled with smoke that the men could hardly breathe, and less even see. Admiral Farragut, in his despatch of September 4th, 1864, says, in speaking of Admiral Buchanan: "He had always been considered one of the ablest officers, and no one knew him better, or appreciated his capacity more highly, than myself."

"Very respectfully, your obedient servant,

"D. G. FARRAGUT,
"Commanding W.G. Blockading Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy."

(*d.*) DESCRIPTION OF THE CONFEDERATE IRON-CLAD *Tennessee.*

THE vessel had been built at Mobile, Alabama, under the superintendence of Messrs. Pierce and Bassett, naval constructors, and Mr. Frick, chief engineer of the station.

(*a*) *Hull.*—The hull of the vessel was exceedingly strongly built in every part, the materials being oak and yellow pine, with iron fastenings. Length from stem to stern on deck, 209 feet; greatest breadth of beam on deck, 48 feet; mean average draught of water, about 14 feet.

The deck was covered fore and aft with wrought-iron plates two inches thick.

The sides of the vessel were protected by an overhang, sponsoned, and covered with two layers of 2-inch wrought-iron.

This overhang extended about six feet below the water-line.

The sides of the vessel below the deck were eight feet thick, and the distance from the knuckle, or outside of the overhang on deck, to the base of the casemate on either side, was ten feet. The vessel was provided with a strong beak or prow, which projects about two feet under water, formed by the continuation of the sponsoning, and covered with wrought-iron plates.

(*b*) *The Casemate* was very strongly built. It was 78 feet 8 inches long, and 28 feet 9 inches wide inside, the sides of the vessel extending 10 feet from it on either side at the greatest breadth of beam.

The framing consisted of heavy yellow pine beams, 13 inches thick, and placed close together vertically. Outside planking of yellow pine, 5½ inches thick, laid on horizontally; and outside of this horizontal planking there was a layer of oak timber 4 inches thick, bolted on vertically, upon which the iron plating was secured.

The plating or armour of the casemate forward was 6 inches thick, consisting of three 2-inch iron plates, of about 6 inches wide each, and abaft and on the sides 5 inches thick, consisting of 2-inch and one 1-inch iron plate of the same width.

The yellow pine framing of the casemate was planked over inside with 2½-inch oak timber, laid on diagonally.

The whole of the armour-plating was fastened with through bolts, 1¼ inch diameter, with washers and nuts inside.

The casemate was covered on top with wrought-iron gratings, composed of bars 2 inches thick and 6 inches wide, laid flat, and supported on wooden beams 12 inches square, and about 5 feet distant from each other. Some of these gratings were hinged and fitted to open from the inside.

There were ten gun-ports in the casemate—three in the broadside on either side, two forward and two aft.

The forward and after parts, to port and starboard, were placed so as to enable the forward and after pivot guns to be used as broadside guns. The directly-forward and after ports were on a line with the keel.

The ports were elongated and made just wide enough for the entrance of the muzzle of the guns in training, and only high enough to allow a moderate elevation and depression of the gun.

The wooden backing was cut away on each side of the ports inside of the casemate, to allow the guns to be trained about one point forward and aft. The gun-ports were covered with wrought-iron sliding plates or shutters 5 inches thick; those for the four broadside guns were fitted in slides. The sliding plates or shutters for the pivot guns were pivoted on the edge with one bolt that could be knocked out, detaching the shutter if necessary, and were worked by a combination of racks and pinions.

(*c*) *Armament.*—The armament of the *Tennessee* consisted of six rifled guns, Brooks' rifles.

The two pivot guns were 7·125-inch bore, and the four broadside guns were 6-inch bore. These guns were reinforced at the breech by two wrought-iron bands, two inches thick respectively. Weight of projectiles, 95 pounds and 110 pounds solid shot. The pivot guns were fitted on wooden slides, with a rack let into them. On an arm attached to the carriage there was a pinion for running out the gun, and by raising the arm the rack was thrown out of gear to allow the gun to recoil.

(*d*) *Quarters for Officers and Crew.*—For an iron-clad vessel the cabin was large and comfortable.

The ward-room was situated immediately over the engine, and was open to it, but although sufficiently commodious, its ventilation was so bad, and the smell arising from the accumulation of bilge-water so offensive, that it would have been impossible for officers or others to preserve their health or to live there comfortably for any length of time.

The quarters of the crew were good and comfortable for an iron-clad vessel of her description. They consisted of a roomy berth-deck, with rooms fitted up on either side for the junior officers. When in port, the crew were quartered on a covered barge, anchored near the vessel.

The steering arrangements were very defective, nor were the accommodations for the pilot and helmsman good.

(*e*) *Machinery.*—The machinery of the vessel consisted of two geared non-condensing engines.

Cylinders, 24 inches diameter and 7 feet stroke. These engines had been taken out of the Alabama river-steamer *Alonzo Child.* They were placed fore and aft in the vessel, geared to an idlershaft by spur gearing with wooden teeth, and from the idlershaft to the propeller-shaft by bevel cast-iron gear.

(*f*) *Boilers.*—There were four horizontal flue-boilers, 24 feet long, placed side by side, with one furnace under the whole of them; the products of combustion returning through the flues were delivered into one smoke-pipe.

The engine and fire-rooms were insufferably hot, and very badly ventilated.

Injuries received in the Action.—Admiral Farragut, after the action, appointed a committee to make a survey of the *Tennessee*, and report on the damages received by her during the engagement. This committee, composed of Captains Thornton, A. Jenkins and James Alden, of Commander William E. Le Roy, and Chief Engineer T. Williamson, report, under date of August 13th, 1864—"The injuries to the casemate of the *Tennessee* from shot are very considerable. On its after-side nearly all the plating is started; one bolt driven in; several nuts knocked off inside; gun-carriage of the after pivot-gun damaged, and the steering rod or chain cut near that gun. There are unmistakable marks on the after part of the casemate of not less than nine 11-inch solid shot having struck within the space of a few square feet in the immediate vicinity of that port. On the port side of the casemate the armour is also badly damaged from shot. On that side, nearly amidships of the casemate, and between the two broadside guns, a 15-inch solid shot knocked a hole through the armour and backing, leaving on the inside an undetached mass of oak and pine splinters, about three by four feet, and projecting inside of the casemate about two feet from the side. This is the only shot that penetrated the wooden backing of the casemate, although there are numerous places on the inside giving evidence of the effect of the shot.

"There are visible between forty and fifty indentations and marks of shot on the hull, deck, and casemate, varying from very severe to slight; nine of the deepest indentations on the after-part of the casemate (evidently being 11-inch shot), and the marks of about thirty of other calibres on different parts of the vessel.

" There are also a few other marks, being, however, merely scratches or slight indentations of the plating.

" The smoke-stack was shot away, although it is not improbable the heavy ramming by the *Monongahela*, *Lachawanna*, and *Hartford* had previously prepared it for its fall.

" Three of the wrought-iron port-shutters or slides were so much damaged by shot as to prevent the firing of the guns.

" There are no external visible marks or evidences of injury inflicted upon the hull of the *Tennessee* by the severe ramming of the *Monongahela*, *Lacwkaanna*, and *Hartford*; but inasmuch as the decks leak badly, and when there is a moderate sea running in the bay, her reported usual leakage of three inches an hour being now increased to five or six inches an hour, it is fairly to be inferred that the increased leakage is caused by the concussion of the vessels.

" The *Tennessee* is in a state to do good service now.

" To restore her to the state of efficiency in which she was when she went into the action with this fleet on the 5th instant, it will be necessary to overhaul much of the iron plating on the port and after sides of the casemate, and replace some of it.

" The iron gun-port slides or shutters, which were damaged, must be either removed or repaired.

" A new smoke-stack is required, and additional ventilators should be fitted.

" Blowers are required to produce proper ventilation in the engine-room and on the berth-deck.

" When these small repairs and additions shall have been made, the iron-clad *Tennessee* will be a most formidable vessel for harbour and river service, and for operating generally in smooth water, both offensively and defensively."

(e.) LOSS OF THE UNITED STATES' STEAMER *Philippi.*

"UNITED STATES' STEAMER *Cowslip*, Aug. 6th, 1864.

"SIR,—I beg leave to make the following report to you in regard to the loss of the United States' Steamer *Philippi*:—

"At daylight, hove up anchor and steamed alongside the *Tennessee*, and discharged all the ordnance stores and provisions belonging to other vessels; not having orders to report to any one, and the verbal order I received being to discharge the stores into the *Tennessee* as quick as possible, I did so. Wishing to be of assistance to the fleet in case any vessels were disabled, and knowing the power of my steamer, immediately after the freight was out I dropped off from the *Tennessee*, got hawsers, lines, &c., all ready to be of assistance in towing any disabled vessel which would need my services. At forty-five minutes past seven, stood up the channel for the fleet, keeping as far out of range of the fort as I could judge was necessary to clear the shoal, the quartermaster at the lead from the time of making the bar. At about fifteen minutes past nine, while going ahead slow, the quartermaster gave the cast, a quarter less three, and the steamer immediately struck. I rang three bells and tried to back her off, but she did not stir. I kept backing for ten minutes; had about thirty-five pounds of steam on. The fort then opened fire on us, and getting our range, every other shell did execution—the second shell or shot (as it did not explode, I could not tell which) struck the rail about the starboard bow-port, and immediately killed Frank Wilson, landsman. One shot passed through the boiler, entirely disabling us, and another burst in the engine-room. At this time Fort Morgan kept up a constant fire at us, every shell doing more or less execution. The men, while I was forward, many of them rushed aft and commenced cutting the boats' falls. Hearing this, I came aft and ordered them to stop, which they did, and the boats were lowered with safety, but the men crowded in, and two of the boats were immediately filled.

I put the wounded in one of the boats, and sent the dying, in charge of Acting Ensign L. R. Vance, to the *Cowslip* for assistance.

"The deck being full of steam and smoke, and indications of the ship being on fire, and two of my men being wounded, and one scalded, and almost every shell, either direct or ricochet, striking the steamer, and the boilers being disabled, and my men, several of them being almost paralyzed with fear, also the sight of the rebel steamer coming out, and the utter impossibility to save the steamer, or resist the enemy, I judged it best to abandon her.

"I pulled alongside the *Cowslip* and *Buckthorn*, the two vessels being close to each other, and put the wounded on board; both vessels then stood towards the *Genessee*. I went on board and reported to Captain Grafton; was ordered to put the wounded on board the *Tennessee*, and report to Captain Grafton again, but as the *Genesee* steamed towards Pelican Channel I was forced to remain on the *Tennessee*. * *

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"JAMES T. SEAVER,
"Acting-Master.

"ADMIRAL D. G. FARRAGUT,
"Commanding W.G.B. Squadron."

(*f.*) LOSS OF THE MONITOR TECUMSEH.

"FLAG-SHIP *Hartford*, W.G. Blockading Squadron,
"Mobile Bay, Aug. 27th, 1864.

"SIR,—I have the honour to forward herewith (marked No. 1) a copy of a report made to me by Acting-Masters C. F. Langley and Gardner Cottrell, two of the survivors of the iron-clad *Tecumseh*, and in which are given the names of six men who were saved in the same boat. These officers are certainly in error in their statement that a row of buoys stretched from the shore a distance of one to two hundred yards. We now know that the channel adjacent to the shore was entirely clear of torpedoes, and that the latter were placed between the two large buoys, to which I have referred in my report. * * * * * * * *

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"Very respectfully, your obedient servant,

"D. G. FARRAGUT,
"Rear-Admiral, Commanding W.G.B. Squadron."

"UNITED STATES' SHIP *Potomac*,
"Pensacola, Aug. 6th, 1864.

"SIR,—Believing that we are the only surviving officers of the United States' Monitor *Tecumseh*, we feel it our duty to report the circumstances attending her loss, and of the safety of a boat's crew.

"When nearly abreast of Fort Morgan, and about 150 yards from the beach, a row of buoys was discovered stretching from the shore, a distance from one to two hundred yards. It being reported to Captain Craven, he immediately gave the vessel full speed, and attempted to pass between two of them. When in their range a torpedo was exploded directly under the turret, blowing a large hole through the bottom of the vessel, through which the water rushed in with great rapidity.

"Finding that the vessel was sinking, the order was given to leave our quarters, and from that moment every one used the utmost exertions to clear himself from the wreck.

"After being carried down by the vessel several times, we were picked up in a drowning condition by one of our boats, manned by the following men :— S. S. Shinn, gunner's mate; John Gould, quarter gunner; Frank Commens, seaman; Richard Collins, seaman, and Peter Parkes, landsman, all of whom are now on board the ship.

"Captain Craven was seen in the turret by Mr. Cottrell, just before the vessel sunk, and as he had a life-preserving vest on, we have hopes that he reached the shore.

"Not recovering from our exhausted condition until the boat was abreast of the *Hartford*, and knowing that an attempt to board one of the attacking fleet would cause the loss of her position, we pulled for the *Buckthorn*, from which vessel we were sent to the *Tennessee*.

* * * * * * *

"C. F. Langley,
"Garner Cottrell,
"Acting-Masters.

"Rear-Admiral D. G. Farragut,
"Commanding W.G. Blockading Squadron."

This conflict had been most desperately fought; it had commenced at six minutes past seven o'clock in the morning and continued till nearly ten o'clock. With the exception of the *Tecumseh*, sunk by a torpedo, the ships had sustained but slight injuries in passing the batteries of Fort Morgan; most of their damages were received in the engagement with the Confederate ram *Tennessee*, and the three wooden gun-boats.

The rigging, and also several guns and gun-carriages, on some of the vessels, had been cut and damaged by fragments of shell; but how comparatively slight the Federal loss and the injuries sustained by the vessels were, may be seen from the following statement:—

Name of Vessel.	No. of Killed.	No. of Wounded.	
Monitor *Tecumseh*	120	0	Lost by a torpedo.
„ *Manhattan*	0	0	Struck 9 times.
„ *Winnebago*	0	0	Struck 19 times.
„ *Chickesaw*	0	0	Struck 3 times by battery of Fort Powell.
Steamer *Brooklyn*	11	43	Struck 30 times.
„ *Octorara*	1	10	Struck 17 times.
„ *Hartford*	25	28	Struck 20 times.
„ *Metacomet*	1	2	Struck 11 times.
„ *Richmond*	0	2 slightly	No serious damage received.
„ *Port Royal*	0	0	Ditto.
„ *Lackawanna*	4	35	5 times hulled.
„ *Seminole*	0	0	Hull not struck at all.
„ *Monongahela*	0	6	Struck 5 times.
„ *Kennebec*	1	6	Struck twice.
„ *Ossipee*	1	7	Struck 4 times.
„ *Itasca*	0	0	Struck once in mainmast.
„ *Oneida*	8	30	Received 1 shot in starboard boiler.
„ *Galena*	0	1	Struck 7 times.

From the foregoing it may be readily seen that a merely partial obstruction of the channel, even with the additional defence of a strong floating battery, does not enable forts to keep out a large fleet.

CHAPTER VII.

VI.—*No Fleet can force a Passage if kept under the Fire of heavy Batteries by properly constructed Obstructions.*

This assertion may be proved by the following instances :—

1.—*First Attack on Fort Sumter.*

(*a.*) ORDER OF BATTLE AND PLAN OF ATTACK UPON CHARLESTON, SOUTH CAROLINA.

"FLAG-SHIP *James Adger*,
"North Edisto, S.C., April 4th, 1863.

"THE bar will be buoyed by the *Keokuk*, Commander Rhind, assisted by C. O. Boutelle, Assistant United States' Coast Survey, commanding the *Bibb*, by Acting-Ensign Platt, and the pilots of the squadron.

"The commanding officers will, previous to crossing, make themselves acquainted with the value of the buoys.

"The vessels will, on signal being made, form in the prescribed order ahead, at intervals from one cable's length.

"The squadron will pass up the main ship channel, without returning the fire of the batteries on Morris Island, unless signal should be made to commence action.

"The ships will open fire on Fort Sumter when within easy range, and will take up a position to the northward and westward of that fortification, engaging its left or north-west face at a distance of from 600 to 800 yards, firing low and aiming at the centre embrasure.

"The commanding officers will instruct their officers and men to carefully avoid wasting a shot, and will enjoin upon them the necessity of precision rather than rapidity of fire.

"Each ship will be prepared to render every assistance possible to vessels that may require it.

"The special côde of signals prepared for the iron-clad vessels will be used in action.

"After the reduction of Fort Sumter, it is probable that the next point of attack will be the batteries on Morris Island.

"The order of battle will be the line ahead in the following succession:—

"1. *Weehawken.*
"2. *Passaic.*
"3. *Montauc.*
"4. *Patapsco.*
"5. *New Ironsides.*
"6. *Catskill.*
"7. *Nantucket.*
"8. *Nahant.*
"9. *Keokuk.*

"A squadron of vessels, of which Captain J. F. Green will be the senior officer, will be formed outside the bar, and near the entrance buoy, consisting of the following vessels: *Canandaigua*, *Housatonic*, *Huron*, *Unadilla*, *Wissahickon*, and will be held in readiness to support the iron-clads when they attack the batteries on Morris Island.

"S. F. DUPONT,
"Rear-Admiral, Commanding S.A.B. Squadron."

(*b.*) DETAILED REPORT OF REAR-ADMIRAL SAMUEL F. DUPONT.

"FLAG-SHIP *Wabash*,
"Port Royal Harbour, S.C., April 15th, 1863.

"SIR. In my previous despatch of April 8th, I gave a brief account of the attack on Fort Sumter on the afternoon of the 7th instant, and I have the honour to present to the Department a more detailed report.

"On the morning of the 2nd instant, I left Port Royal for North Edisto, hoisting my flag on the United States' steamer *James Adger*, Commander Patterson, and crossed the bar the same day.

"As there was some reason to believe that, on the departure of the iron-clads from Port Royal, there might be an attempt to commit a raid by the *Atlanta* and other rams at Savannah, and as the army was apprehensive of an attack on their positions at Hilton Head and Beaufort, I had ordered Captain Steadman to Port Royal with his vessel, the *Paul Jones*, having previously directed the *Wabash*, Commander Corbin, and *Vermont*, Commander Reynolds, to be hauled over to the Hilton Head shore, to protect the vast amount of public property there. The *Sebago* was also stationed in Calibogue Sound; the *Marblehead*, in Savannah River, and the *E. B. Hale*, in Broad River; whilst the *Paul Jones*, owing to her light draught, was also to make frequent reconnoissances up the latter stream and the Beaufort River.

"On the 5th instant, having provided steamers to tow the iron-clads, I left North Edisto for Charleston, with all the vessels intended to participate in the attack on that place, and arrived there in the afternoon.

"In accordance with my previous arrangements, the *Keokuk*, Commander Rhind, aided by Captain Boutelle, of the United States' Coast Survey, and Acting-Master Platt, with Pilot Godfrey and others, proceeded at once to buoy the bar, and to report the depths of water which could be availed of in crossing the next morning with the *New Ironsides*.

"The *Patapsco*, Commander Ammen, and the *Catskill*, Commander G. W. Rodgers, covered the *Keokuk* during this operation, and afterwards anchored inside of the bar that same evening, in order to protect the buoys.

"On the morning of the 6th instant I crossed the bar with the *New Ironsides*, Commodore T. Turner, and the rest of the iron-clads, viz. *Passaic*, Captain Drayton; *Weehawken*, Captain John Rodgers; *Montauc*, Captain J. S. Worden; *Patapsco*, Commodore Ammen; *Catskill*, Commander G. W. Rodgers; *Nantucket*, Commander Fairfax; *Nahant*, Commander Downes; and the *Keokuk*, Commander Rhind, intending to proceed the same day to the attack of Fort Sumter, and thence to the city of Charleston; but after reaching an anchorage inside, the weather became so hazy, preventing our seeing the ranges, that the pilots declined to go further. I herewith enclose (marked No. 1) the order of battle and the plan of attack, in which the *Weehaucken*, Captain John Rodgers, with a raft in front, was to be the leading vessel of the line, and the *Keokuk*, Commander Rhind, was to be the last, the *New Ironsides* being in the centre, from which signals could be better made to both ends of the line.

"On the following day, April 7th, at noon, this being the earliest hour at which, owing to the state of the tide, the pilots would consent to move, I made signal to the vessels to weigh anchor, having previously ordered them not to reply to the batteries on Morris Island, but reserve their fire until they could pass Fort Sumter, in case there were no obstructions, and attack the north-west face. The chain of the *Weehaucken*, the leading vessel, had, however, become entangled in the grapnels of the pioneer raft, and the vessels were delayed in moving until about fifteen minutes past one, when, everything being clear, the *Weehawken* moved on, followed by the *Passaic* and others in the regular order of battle.

"On the way up, the leading vessel passed a number of buoys strewed about in every direction, causing a suspicion of torpedoes, one of which burst near the *Weehawken*, without, however, producing any serious injury.

"At ten minutes past two, the *Weehawken*, the leading vessel, signalled obstructions in her vicinity, and soon after approached very close to them. They extended across the harbour from Fort Moultrie to Fort Sumter, and were marked by rows of casks very near together and in several lines. Beyond these again, piles were seen extending from James Island to the middle ground.

"At 2.50, the guns of Fort Moultrie opened upon the *Weehawken*, followed shortly after by all the batteries on Sullivan's Island and Fort Sumter.

"Not being able to pass the obstructions, the *Weehawken*, and successively the *Passaic*, *Nahant*, and others, were obliged to turn, which threw the line into some confusion as the other vessels approached. This was particularly the case with the flag-ship, which became, in a measure, entangled with the Monitors, and could not bring her battery to bear upon Fort Sumter without great risk of firing into them. She was obliged on her way up to anchor twice, to prevent her from going ashore, and on one of these occasions in consequence of having come into collision with two of the iron-clads.

"The Monitors and the *Keokuk* were able to get within easy range of Fort Sumter, at distances varying from 550 to 800 yards, in which positions they were subjected successively to a tremendous concentrated fire from all the batteries on Sullivan's Island, Morris Island, Sumter, and others of the most formidable kind, and from guns of the heaviest calibre.

"Not being able to place the *New Ironsides* where I desired, though she was within a distance of 1000 yards, and evening approaching, at 4.30 I made signal to withdraw from action, intending to resume the attack the next morning.

"During the evening, the commanding officers of the iron-clads came on board the flag-ship, and, to my regret, I soon became convinced of the utter impracticability of taking the city of Charleston by the force under my command.

"No ship had been exposed to the severest fire of the enemy over forty minutes, and yet, in that brief period, as the Department will perceive by the detailed reports of the commanding officers, five of the iron-clads were wholly or partially disabled; disabled, too (as the obstructions could not be passed), in that which was most essential to our success—I mean in their armament, or their power of inflicting injury by their guns.

"Commander Rhind, in the *Keokuk*, had only been able to fire three times during the short period he was exposed to the guns of the enemy, and was obliged to withdraw from action to prevent his vessel from sinking, which event occurred on the following morning.

"The *Nahant*, Commander Downes, was most seriously damaged, her turret being so jammed as effectually to prevent its turning; many of the bolts of both turret and pilot-house were broken, and the latter became nearly untenable, in consequence of the nuts and ends flying across it.

"Captain P. Drayton, in the *Passaic*, after the fourth fire from her 11-inch gun, was unable to use it again during the action; and his turret also became jammed, though he was, after some delay, enabled to get in motion again.

"Commander Ammen, of the *Paptasco*, lost the use of the rifled gun after the fifth fire, owing to the carrying away of the forward-cap square bolts. On the *Nantucket*, Commander Fairfax reports, that after the third shot from the 15-inch gun, the port stopper became jammed, several shot striking very near the port and driving in the plates, preventing the further use of that gun during the action.

"The other iron-clads, though struck many times severely, were still able to use their guns, but I am convinced that, in all probability, in another thirty minutes they would have been likewise disabled.

"In the detailed reports herewith forwarded from the commanding officers of all the vessels engaged, excepting that of the *New Ironsides*, not yet received (respectively marked Nos. 2, 3, 4, 5, 6, 7, 8, 9), the Department will be fully informed of the character and extent of the injuries received by these vessels, and to which I have only partially referred.

"I also forward herewith a statement in tabular form (marked No. 10), drawn up by the ordnance officer, Lieutenant Mackenzie, by which, among other things, it appears that only one hundred and thirty-nine shot and shell were fired by our vessels, though, during that same period, the enemy poured upon us an incessant storm of round-shot and shell, rifled projectiles of all descriptions, and red-hot shot.

"Any attempt to pass through the obstructions I have referred to would have entangled the vessels, and held them under the most severe fire of heavy ordnance that has ever been delivered; and, while it is barely possible that some vessels might have forced their way through, it would only have been to be again impeded by fresh and more formidable obstructions, and to encounter other powerful batteries, with which the whole harbour of Charleston has been lined.

"I had hoped that the endurance of the iron-clads would have enabled them to have borne any weight of fire to which they might have been exposed; but when I found that so large a portion of them were wholly or one-half disabled, by less than an hour's engagement, before attempting to remove (overcome) the obstructions, or testing the power of the torpedoes, I was convinced that persistence in the attack would only result in the loss of the greater portion of the iron-clad fleet, and in leaving many of them inside the harbour to fall into the hands of the enemy.

"The slowness of our fire and our inability to occupy any battery that we might silence, or to prevent its being restored under cover of night, were difficulties of the gravest character, and until the outer forts should have been taken, the army could not enter the harbour or afford me any assistance.

"The want of success, however, will not prevent me from bringing to the notice of the Department the gallant officers and men who took part in this desperate conflict.

"Commodore Turner of the *New Ironsides*, Captain Drayton in the *Passaic*, Captain John Rodgers of the *Weehawken*, Captain T. L. Worden of the *Montauk*, Commander Ammen of the *Patapsco*, Commander George W. Rodgers of the *Catskill*, Commander Fairfax of the *Nantucket*, Commander Downes of the *Nahant*, and Commander Rhind of the *Keokuk*, did everything that the utmost gallantry and skill could accomplish in the management of their untried vessels. These commanding officers have long been known to me; many of them served in this squadron before, and were present at the capture of the Port Royal forts; they are men of the highest professional capacity and courage, and fully sustained their reputations, coming up to my requirements. I commend them and their reports, which speak of those under them, to the consideration of the Department.

"I took my personal staff with me to the *New Ironsides*. On this, as on all other occasions, I had invaluable assistance from the fleet-captain, Commander C. R. P. Rodgers, who was with me in the pilot-house, directing the movements of the squadron. For now over eighteen months in this war this officer has been afloat with me, and, in my opinion, no language could overstate his services to his country, to this fleet, and to myself as its commander-in-chief.

"Lieutenant S. W. Preston, my flag-lieutenant, who has also been with me for the same period, exhibited his usual vigilance and zeal, and with that ability which is so far beyond his years, he arranged a special code of signals, which was used and served on the gun-deck battery of the *New Ironsides*.

"My aid, Ensign M. L. Johnson, full of spirit and energy, made the signals under difficult circumstances, and kept an accurate note of all that were made to and from the fleet.

"Lieutenant A. S. Mackenzie, the ordnance officer of the squadron, had been preparing his department of the expedition with ceaseless labour, care, and intelligence. He served also on the gun-deck of the *New Ironsides*.

"The reserved squadron of wooden vessels referred to in my general order of battle, under Captain J. F. Green, of the

Canandaigua, was always in readiness, but their services in the engagement were not called into action.

"Very respectfully, your obedient servant,

"S. F. DUPONT,
"Rear-Admiral, Commanding S.A.B. Squadron."

(*c.*) REPORT OF CAPTAIN PERCIVAL DRAYTON, COMMANDING UNITED STATES' IRON-CLAD *Passaic*.

"UNITED STATES' IRON-CLAD *Passaic*,
"Off Morris Island, S.C., April 8th, 1863.

"IN obedience to your signal, I yesterday, at 12.30, got under way, prepared to follow the *Weehawken*, which vessel had on the bow a raft-projection for catching torpedoes; this, however, pulling her anchor and causing some delay, I at 12.40 signalled for permission to go ahead. The *Weehawken*, however, having at length cleared her anchor, proceeded at 1·15 towards Charleston, followed by this vessel. On the way up, a number of buoys of various descriptions were passed, strewed about in every direction, and causing suspicion of torpedoes, one of which machines we saw burst under the bow of the *Weehawken*. At 2.50, Fort Moultrie and the batteries on Sullivan's Island opened, to which I replied with the 11-inch in passing, and pushed on towards Fort Sumter, whose guns began almost immediately to fire, and were at once answered by my two. When opposite the centre of the fort, we came pretty close to some obstructions which seemed to extend the whole way from Fort Moultrie across; here I stopped, as the *Weehawken* had done just before. At the fourth shot from 11-inch gun, I was struck in quick succession in the lower part of the turret by two heavy shot, which bulged in its plates and beams, and forcing together the rails on which the 11-inch carriage worked, rendered it wholly useless for the remainder of the action, several hours being necessary to put it again in working order. Soon after it was discovered that there was something the matter with the turret itself, which could not be moved; and on examination it was found that a part of the brass ring underneath it had been broken off, and being forced inboard, had jammed; on clearing this, the turret could again be moved, but for some time irregularly.

"A little after, a very heavy rifle-shot struck the upper edge of the turret, broke all of its eleven plates, and then glancing upwards took the pilot-house, yet with such force as to make an indentation of two and a half inches, extending nearly the whole length of the shot. The blow was so severe as to considerably mash in the pilot-house, bend it over, open the plates and squeeze out the stop, so that on one side it was lifted up three inches above the top on which it rested, exposing the inside of the pilot-house, and rendering it likely that the next shot would take off the top itself entirely.

"At 4.10, being desirous of more carefully examining into the injuries to the gun-carriage and turret, as the engineer thought one of the braces which support the latter was broken, and also to see what was the external injury to the pilot-house, and whether it was possible to get the top into place, and not being able to do this in the crowd of vessels which were all around, and under so fierce a fire, I dropped a little below Fort Moultrie and anchored, having signalled for your permission, which was not, I think, seen, however.

"I soon satisfied myself that there was nothing to be done either to the pilot-house or 11-inch gun; and the injury to the turret not proving very serious, I was just about returning to the upper fort when you made signal to follow your motions, and very soon after, at 4.30, to retire from action.

"At five I got under way, and followed the *Ironsides* to my present anchorage.

"The only really serious injuries were the ones mentioned above, although the vessel was struck thirty-five times, as follows: outside armour, fifteen times, which it has been too rough to examine; deck, five times, once very badly; turret, ten times;

pilot-house, twice; smoke-pipe, once; flag-staff over turret shot away, and boat shattered.

"There was a little motion, and in consequence some of the outside shots are low down. Several bolt-heads were knocked off and thrown into the pilot-house and turret, and the former might have done some serious injury to those inside, had they not been stopped by a sheet-iron lining which I had placed there while at Port Royal.

"Owing to the delays caused by the various accidents ending in the entire disabling of one gun, I was only able to fire four times from the 11-inch and nine from the 15-inch gun. There was some loss of time also from the necessity of using the sectional rammer, as the fire was all around and required the ports to be kept closed.

"On account of the dense smoke, I was not able to see the effect of my own shots, but, except a few scars, I could not perceive either yesterday or this morning, when I had a very good view of its lower face, that the fort was in the least injured, and am satisfied that our limited number of guns, with their slow fire and liability to get out of order, were no match for the hundreds which were concentrated on them, at distances perhaps scarcely anywhere beyond a half mile, and nearly as well protected against injury from shot as were ours.

"I could see several ranges of piles running nearly across the upper harbour, the first line having a narrow opening, just beyond which were the enemy's steamers, three of them apparently iron-clads.

"I was more than usually incommoded by smoke during the action, owing, no doubt, to the difficulty of keeping the blower-bands in working order, with such an amount of water as has been for days pouring over them through the lower part of the turret—a most serious evil, and which, I think, calls for a remedy, if the turret-system is to be kept up in any but the smoothest water.

"My experience at Fort M'Allister satisfied me that the decks were not strong enough; and this of Fort Sumter, that the pilot-house is not capable of withstanding heavy shot for any length of time, and even throws a doubt on the turret itself, or, at least, its machinery.

"The fire to which we were subjected was as fierce, I suspect, as vessels are often exposed to; and one of my officers, who was below, tells me that, at one time, in a few seconds, he counted fifteen shots, which passed over his head just above the deck, and, at times, the whistling was so rapid, he could not keep count at all.

"This certainly shows how much battering our iron-clads escaped by being so low on the water. You probably observed yourself, in the *Ironsides*, the great difficulty of managing these vessels, and keeping them clear of each other and the bottom, with the limited power of vision which the holes in the pilot-house afford; and when to this is added the smoke, I consider it a piece of great good luck that none of us got ashore, or received injury from collision.

"In conclusion, I have to thank Lieutenant Commanding Miller, and the other officers, and the crew generally, for the quiet and efficient manner in which all their duties were performed.

"I am, very respectfully, your obedient servant,

"P. DRAYTON, Captain.

"REAR-ADMIRAL S. F. DUPONT,
"Commanding S.A.B. Squadron, Flag-ship *Ironsides*."

(*d.*) REPORT OF CAPTAIN JOHN RODGERS, COMMANDING UNITED STATES' IRON-CLAD *Weehawken*.

"UNITED STATES' STEAMER *Weehawken*,
"Inside Charleston Bar, S.C., April 8th, 1863.

"SIR,—I have the honour to submit the following report:—

"Yesterday, April 7th, one of the grapnels of the raft attached to us became so entangled in our chain that the *Weehawken* was detained about two hours in getting under way. In obedience to given signal, we succeeded, however, in arriving under the fire of Fort Sumter at about 2.50 P.M.

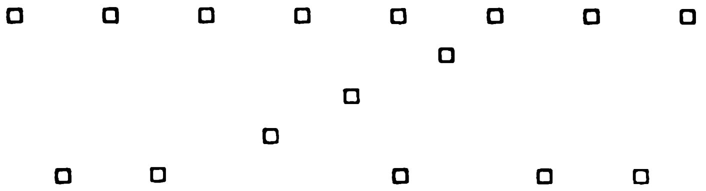
"The accuracy of the shooting on the part of the rebels was very great, having been obtained, no doubt, by practice at range targets, since I remarked that, as we passed a buoy, all the guns opened at once. The missiles were very formidable, being, I infer, from their marks, bolts, balls, rifled-shell, and steel-pointed shot. More than 100 guns, I think, fired upon us at once, with great rapidity, and mostly at short range. My counted shot-marks are fifty-three; some, I presume, have escaped attention.

"Two or three heavy shot struck the side-armour near the same place. They have so broken the iron that it only remains in splintered fragments upon that spot; much of it can be picked off by hand, and the wood is exposed.

"The deck was pierced so as to make a hole, through which water ran into the vessel; but it was not large. Thirty-six bolts were broken in the turret, and a good many in the pilot-house; but as these are concealed by an iron lining, I have no means of knowing how many.

"At one time, the turret revolved with difficulty in consequence of a shot upon its junction with the pilot-house; but it worked well again after a few turns had been made with higher steam. The guns and carriages performed well. At 5 o'clock, in obedience to signal, withdrew from the range of fire, and anchored. From the nature of the attack, the vessels were alternately under the hottest fire, and no one, I presume, may be said to have had it very severe for more than forty minutes.

"We approached very close to the obstructions extending from Fort Sumter to Fort Moultrie—as near, indeed, as I could get without running upon them. They were marked by rows of casks very near together. To the eye they appeared almost to touch one another, and there was more than one line of them. To me they appeared thus:—



"The appearance was so formidable that, upon deliberate judgment, I thought it right not to entangle the vessel in obstructions which I did not think we could have passed through, and in which we could have been caught. Beyond these, piles were seen, between Castle Pinckney and the middle ground.

"A torpedo exploded under us, or very near to us. It lifted the vessel a little, but I am unable to perceive that it has done us any damage. I have no accident to report.

"The raft which we had attached to our bow did not much impede our steering; but while lying at anchor the waves converted it into a huge battering-ram. In two days it had started the armour upon our bow. No vessel can carry it except in smooth water. Its motions did not correspond to the movements of the *Weehawken*. Sometimes, when she rose to the sea, the raft fell, and the reverse. Thus, we were threatened with having it on our decks or under the overhang. No prudent man would have carried the torpedo attached to the raft in a fleet. An accidental collision would blow up his own friend, and he would be more dreaded than an enemy. * * * * * *

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"With your present means, I could not, if I were asked, recommend a renewal of the attack.

"I have the honour to be, your obedient servant,

"JOHN RODGERS, Captain.

"REAR-ADMIRAL S. F. DU PONT,
"Commanding S.A.B. Squadron."

(*e*.) REPORT OF CAPTAIN JOHN L. WORDEN, COMMANDING UNITED STATES' IRON-CLAD *Montauk*.

"UNITED STATES' STEAMER *Montauk*,
"Inside Charleston Bar, April 8th, 1863.

"SIR,—I have the honour to report that, on yesterday, at thirty minutes past noon, this vessel got under way, in accordance with signal from the flag-ship, taking the position assigned in line next astern of the *Passaic*, and proceeded up the channel. At fifty minutes past two o'clock P.M., Fort Moultrie opened fire at long range upon the advanced vessels, and soon after all the forts on Sullivan's Island, and the two upon the upper end of Morris Island, did the same. At ten minutes past three o'clock, this vessel opened fire upon Fort Sumter at about 800 yards' distance, and still advancing. A few minutes later, the leading vessels having stopped in position about 600 yards from the fort, I also stopped in my assigned position, near the *Passaic*, and at about the same distance from the fort as the other vessels, and delivered my fire deliberately.

"Some minutes later, the flood tide having made, and setting the vessel close to some formidable-looking obstructions (which I deemed it highly important to avoid), they turned their heads towards the flood, and I followed in their wake. As soon as I could get my vessel under control, which it was quite difficult to do in avoiding the other vessels, I turned towards the fort again, got within about 700 yards of it, and delivered my fire as long as I was able to hold that position; but the tide drifting us, and the other vessels being close around me, I again turned to avoid fouling them, still delivering my fire as opportunity occurred.

"At about five o'clock, I ceased firing, and withdrew from action, in accordance with signal from flag-ship, and stood slowly down against the tide, and, at 5.40 o'clock P.M., anchored in the channel about two and one-quarter miles below Fort Sumter.

"For about fifty minutes only the vessels of the fleet were under a concentrated and terrific fire, and received their injuries during that time.

"This vessel was hit fourteen times, but received no material damage. I enclose a report of the injuries she received, and another of the ammunition expended.

"I am happy to be able to report no casualties.

"I desire to say that I experienced serious embarrassment in manœuvring my vessel in the narrow and uncertain channel, with the limited means of observation afforded from the pilot-house, under the rapid and concentrated fire from the forts, the vessels of the fleet close around me, and neither compass nor buoys to guide me.

"After testing the weight of the enemy's fire, and observing the obstructions, I am led to believe that Charleston cannot be taken by the naval force now present, and that, had the attack been continued, it could not have failed to result in disaster.

"To the officers and crew *en masse* I can proudly give unbounded praise for their coolness and efficiency, and for their cheerful and ready support. * * * *

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"Very respectfully, your obedient servant,

"John L. Worden.
"Captain, Commanding *Montauk*.

"Rear-Admiral S. F. Dupont,
"Commanding S.A.B. Squadron."

(*f*.) Report of Lieutenant-Commander C. H. Cushman, of Injuries sustained by the *Montauk*.

"The following is the report of the effect upon the United States' steamer *Montauk* of the enemy's fire in the attack on Fort Sumter, April 7th, 1863:—

"Hits on side armour, four. One of these is severe, detaching the entire after-starboard section of plating about three-eighths of an inch from the backing. The section will require re-fastening. Three of these are not injuries.

"Hits on turret, three; none injuries.

"Hits on pilot-house, one. This hit is tolerably severe, loosening three bolts, and starting in the plating somewhat. In addition, there are some light scars from grape or langrage.

"Hits on deck-plating, three; none very severe. In addition, there are some grape-marks also on deck, and one grape-shot lodged between bolts of forward warping chock.

"Hits on upper smoke-stack, three; all unimportant. Second cutter was cut adrift, and lost; and flags and staffs considerably riddled by grape-shot.

"Respectfully, &c. &c.

"C. H. CUSSMAN.
"Lieutenant Commanding and Executive Officer.

"CAPTAIN JOHN L. WORDEN,
"United States' Steamer *Montauk*."

(*g*.) REPORT OF COMMANDER DANIEL AMMEN, COMMANDING UNITED STATES' IRON-CLAD *Patapsco*.

"IRON-CLAD *Patapsco*,
"Port Royal Harbour, S.C., April 14th, 1863.

"SIR,—I have the honour to report that, on arriving off Charleston, on the afternoon of the 5th, I proceeded, as directed, to cover the movements of the *Keokuk* when she sounded the bar, anchoring with the *Catskill* as near as safety would permit. It was near sunset when the work was completed, and our pilot had received instructions. The *Patapsco* was immediately got under way, crossed the bar, and anchored near the inner buoy. After dark, we were joined by the *Catskill*. At 11 P.M., a steamer was discovered approaching from the direction of Charleston. She left as soon as she found herself in our vicinity, and disappeared before I had an opportunity to fire on her. In obedience to your signal, at 12.15 P.M. of the 7th, we got under way, and took the position in line as assigned. Owing to unavoidable delays at the head of the line, the leading vessel reached an effective range for the heavy ordnance of the enemy at about 3 P.M., when she was opened upon from Fort Sumter, and, shortly after, from a sand-battery above Fort Moultrie, with adjacent sand-batteries, sand-battery Beauregard, and the heavy guns on Cumming's Point.

"The *Patapsco* was the fourth vessel in line, and at 3.10 opened with the 150-pounder rifle, when at a distance of 1500 yards from Sumter. Following in position, we opened, when at about 1200 yards, with the heavy gun. After the fifth discharge of the rifle, that gun was rendered useless, from carrying away the forward cap square bolts; an injury which could not be repaired for two hours, notwithstanding the strenuous exertions of the executive officer and the senior engineer.

"Shortly after our leading vessel, following the head of the line, turned seaward. At that time, or before, I discovered several rows of buoys above us; also one or two rows of piles or heavily moored wooden buoys above them, one row, to the left of Sumter, high out of the water. This last appeared to be some distance above. Endeavouring to turn, a ship's length short of the *Montauk*, we found the headway of the vessel cease, and that she no longer obeyed the helm. Backing, we got off, but had been sufficiently long on the enemy's obstruction to receive the concentrated fire of the batteries mentioned, consisting, as far as I can judge from the marks and pieces, of projectiles of 7 and 8 inch rifles and 10 and 11 inch columbiads. At this time we were probably within 600 yards from Fort Moultrie, and a little more than double the distance from Sumter.

"We had passed several buoys for range of guns or other purposes on going up, and after getting off of the obstructions, passed down on the same side. Although I endeavoured, I found it impossible at the time to make the signal that we were on an obstruction, and I have to regret that, observing the effect of our fire, the want of space or means of observation in the pilot-house, and manœuvring the vessel, prevented that close observation of the obstructions or the forces of the batteries of the enemy which would have been desirable, the seeing of all the signals made by you, or the accurate noting of the times.

"After a few heavy blows on the turret, the quantity of steam, before ample to turn it, was insufficient, and this was also cause of annoyance, delay, and a decreased fire from the only gun available.

"Obeying the signal to withdraw from action, I anchored on the port bow of the *New Ironsides*, ready to aid her if required, and afterwards, obeying instructions, anchored for the night in line.

"Forty-seven projectiles of the enemy struck the vessel. No damage was done which disabled her, although injuries were received which multiplied would do so. Forty bolts of the smoke-stack were broken, and a chain around it will be necessary to its continued security.

"The officers and crew acquitted themselves as usual. I am indebted to Acting-Master Vaughan, transferred temporarily to this vessel, for valuable aid in avoiding collisions, as it is out of the question for one person to observe properly from the various light holes. I think a want of vision one of the most serious defects of this class, making it impossible to fight them advantageously, to avoid dangers, or to make a satisfactory reconnoissance.

"Another question of great importance as relates to their efficient employment is the character of the battery. If it is proposed to batter down forts with a 15-inch gun, then it is quite plain that we have to come within distances at which heavy ordnance, if employed in heavy batteries against us, cannot fail in the end to injure or perhaps disable us. A comparatively light projectile, with the same charge of powder, might enable us to take such distance as would be effective, and yet be comparatively free from injury to us.

"Owing to the early disabling of the rifle, and the various discomfitures referred to, only five projectiles were fired from each gun. I saw several of them were effective.

"I have the honour to be, very respectfully, your obedient servant,

"DANIEL AMMEN, Commander.

"REAR-ADMIRAL S. F. DUPONT,
"Commanding S.A.B. Squadron."

(*h.*) REPORT OF COMMANDER GEORGE W. RODGERS, COMMANDING UNITED STATES' IRON-CLAD *Catskill*.

"UNITED STATES' IRON-CLAD *Catskill*,
"Inside Charleston Bar, April 8th, 1863.

"SIR,—I have the honour to report that immediately after the arrival of this ship off Charleston, on the 5th instant, I went close in to the bar, to cover the *Keokuk* while sounding out the channel. About sundown, the channel having been buoyed, I got under way, in obedience to your order, and went over the bar. It was too dark to see the buoys, but the *Patapsco* having gone over, and being alone inside, I pushed on and anchored safely inside. During the night, a steamer came in sight, apparently reconnoitring, but returned upon being discovered. The 6th, the weather was too thick to see the ranges for proceeding up the channel. The 7th, at 12.15 P.M., in obedience to signal, I got under way with the fleet. At 1.45, having formed in order of battle, line ahead, my position being next astern the flag-ship, started ahead. At 2.50, Forts Moultrie, Sumter, and Beauregard, with the batteries at Cumming's Point, Mount Pleasant, and the causeway or redan extending from Fort Moultrie, opened upon the head of the line: the flag-ship becoming unmanageable from shoal water and strong tide, I passed her. At 3.35, the first shot struck the *Catskill*, and at 3.39 I opened fire upon Fort Sumter, disregarding the others, the leading vessels having proceeded as far as the obstructions. I pushed on, and approaching within 600 yards of Fort Sumter, near the *Keokuk*, continued my fire, which I could see take effect: one 15-inch shot apparently dismounted one of the barbette guns. At 5, in obedience to signal, I withdrew from action and anchored with the fleet inside the bar, out of range.

"The cross-fire from the forts and batteries was most severe. Several lines of buoys extended from Fort Sumter across the channel, and from the middle ground extended a row of piles, inside of which were several steamers. I was surprised to find, even with this severe fire, that these vessels could be so much injured in so short a time, two or three having passed me during the action to which some disaster had happened. This vessel was struck some twenty times, but without any serious injury, except one shot upon the forward part of the deck, which broke both plates, the deck planking, and drove down the iron stanchion sustaining this beam about one inch, causing the deck to leak.

"I am glad to say that no person was injured during the engagement. The officers and crew of this vessel all behaved with coolness and courage. Lieutenant-Commander C. C. Carpenter, the executive officer, and Acting-Master T. W. Simmons, directed the fire of the guns in the turret with energy and skill. To Senior Engineer George D. Cimmons and Peter Trescott, quartermaster, who steered this ship, I am much indebted for the assistance rendered me.

"I am, very respectfully, your obedient servant,

"G. W. RODGERS, Commander.

"REAR ADMIRAL S. F. DUPONT,
"Commanding S.A.B. Squadron."

(i.) REPORT OF COMMANDER D. McN. FAIRFAX, COMMANDING UNITED STATES' IRON-CLAD *Nantucket*.

"UNITED STATES' IRON-CLAD *Nantucket*,
"Off Cumming's Point, April 8th, 1863.

"SIR,—I have the honour to make the following report of the part taken by this vessel in the attack of yesterday upon the forts at the entrance to Charleston by the iron-clad fleet under your command.

"At 1.15 P.M., in obedience to a general signal from the flag-ship, weighed anchor and took up a position the seventh vessel in order of battle, 'the line ahead.'

"At 2.50, the batteries opened their fire upon our advanced line. About this time the *New Ironsides* seemed to have become unmanageable, falling off and out of line, with her head down stream. Her slow progress prevented the rearmost vessels from closing up with those already under fire. It was then the signal was thrown out to 'disregard the motions of the Commander-in-Chief,' and the rearmost vessels pushed on to gain a position within effective range of the forts.

"At 3.20, the guns from Fort Beauregard opened upon this vessel at a distance of 750 yards. At 3.50, having arrived within 750 yards of Fort Sumter and 1000 yards of Moultrie, I directed the fire of the two guns to be opened upon Fort Sumter. We were then under the fire of three forts, and most terrific was it for forty-five to fifty minutes. Our fire was very slow, necessarily, and not half so observable upon the walls of the forts as the rain of the rifle-shot and heavy shell was upon this vessel. After the third shot from the 15-inch gun the port stopper became jammed, several shot striking very near the port, and driving in the plating: it was not used again. The 11-inch gun was fired during the entire time of one hour and fifteen minutes only twelve times.

"At five o'clock, the signal to cease firing was made. As the fleet withdrew, the forts materially slackened their fire, evidently not wishing to expend their ammunition without some result. Certainly, their firing was excellent throughout; fortunately, it was directed to some half-dozen iron-clads at a time. The effect of their fire upon the *Keokuk*, together with that of their heavy rifle-shot upon the Monitors, is sufficient proof that any one vessel could not have long withstood the concentrated fire of the enemy's batteries.

"The obstructions being placed at a concentrated point of fire from the three forts shows, conclusively, that they must have been of no mean character. Our fire always drew down upon us four or five heavy rifle-shots, aimed at our ports. One rifle-shot struck within less than six inches of the 15-inch port; several struck very near. I am convinced that, although this class of vessels can stand a very heavy fire, yet the want of more guns will render them comparatively harmless before formidable earthworks and forts. I must say that I am disappointed beyond measure at this experiment of Monitors overcoming strong forts. It was a fair trial. * * *

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"Herewith are the reports of the executive officer and senior engineer. They will explain the condition of the vessel after the attack.

"Very respectfully, your obedient servant,

"D. McN. Fairfax,
"Commander, U.S. Navy.

"Rear-Admiral S. F. Dupont,
"Commanding S.A.B. Squadron."

(*k*.) Report of Lieutenant-Commander L. A. Beardslee, of Injuries sustained by the *Nantucket*.

"United States' Iron-clad *Nantucket*,
"Inside Charleston Bar, April 8th, 1863.

"Sir,—In obedience to your order, I furnish you with a statement of the injuries received by this ship during the engagement yesterday.

"We were struck fifty-one times, besides a number of dents by fragments of shells. The turret was struck eighteen times, principally by 10-inch solid and 6-inch rifle-shot. One rifle-shot struck on the lower corner of the 15-inch port, denting the outer plate about an inch and a half, and bulging the whole thickness so much as to prevent the port stopper from swinging. This shot was received after the third fire of the 15-inch, and disabled the gun for the rest of the fight, we not being able to open the port. A 10-inch shot struck directly opposite, and near the top of the turret, starting a number of bolts, and breaking the clamp-ring inside. The others did no serious damage further than breaking and loosening a number of bolts. There may be more damage, but we will not be able to ascertain without removing the 'pilasters' covering the bolt-heads—a job that cannot be done without, for the time, disabling the turret. During the action the turret became jammed. Upon examination, we discovered six or seven bolt-heads and nuts that had fallen inside, and into the recess around the bottom of the turret, rendering it necessary to key the turret higher in order to clear them. Upon attempting to revolve the turret again to-day, found that another had fallen since the first were removed. The pilot-house was struck once, a square hit, but doing no damage. The side armour was struck nine times—once below the water-line. A number of the side plates are started so much that another shot in their vicinity would, in my opinion, knock them off. One bolt was driven through the iron, and is buried in the oak. One of the deck plates is started from a blow on the side armour. The smoke-stack was riddled in the upper sections, and received five shots in the lower sections—one, a solid 10-inch, fell, after striking upon the deck, and was secured.

"The steam whistle was cut off. The deck plates were cut in twelve places. One shot cut through the iron, and about two inches into the beam, starting the plate, several bolts, and the planking for some feet below. This was directly over the Andrews pump, in the engine-room. The others are not serious. The first discharge of 15-inch gun blew off eight of the heads of the bolts securing the muzzle-box. The discharge of the 11-inch gun, or else the blow of a shot on the turret, lifted one of the perforated plates on top. These plates are not properly secured. The outer turret place, in 15-inch port, is started about one-fourth of an inch; the next layer in a less degree. Two of the 'guides' to the 11-carriage were carried away through the gun not being properly compressed. Some of the gear to the engine-room bell was disabled at the first fire, causing trouble and confusion in getting orders promptly conveyed from pilot-house to engine-room. Fortunately, we had had a speaking tube from the turret-chamber to the engine-room put up at Port Royal. The ship is tight, and can, if necessary, go into another fight at once; but to do so would, in my opinion, greatly endanger the ship, unless considerable repairs are first given her, there being several places too much weakened to resist a second blow.

"Very respectfully, your obedient servant,

"L. A. BEARDSLEE,
"Lieutenant Commanding and Executive Officer.

"COMMANDER D. McN. FAIRFAX, U.S.N.,
"United States' Iron-clad *Nantucket*."

(*l.*) REPORT OF COMMANDER JOHN DOWNES, COMMANDING UNITED STATES' IRON-CLAD *Nahant*.

"UNITED STATES' IRON-CLAD STEAMER *Nahant*,
"Port Royal, April 13th, 1863.

"SIR,—I have the honour to submit the following account of the part taken by this vessel in the action of the 7th instant with the forts and batteries in Charleston harbour.

"Weighing anchor, in compliance with signal, we occupied the position assigned us in the order of battle, next to the rear of the line, entering into action at about three P.M., and at four o'clock becoming hotly engaged with Forts Sumter and Moultrie, and the various other batteries which lined the northern shore of the harbour, and concentrated an intense fire upon us, while floating obstructions of a formidable nature, apparently drawn between Moultrie and Sumter, barred the way to further progress up the harbour.

"We soon began to suffer from the effects of the terrible—and, I believe, almost unprecedented—fire to which we were exposed, and at 4.30 the turret refused to turn, having become jammed from the effects of three blows from heavy shot, two of them on the composition ring about the base of the pilot-house (one of these breaking off a piece of iron weighing 78 lbs. from the interior that assisted to keep the house square on its bearings, throwing it with such violence to the other side of the house, striking, bending, and disarranging steering-gear in its course, that it bounded from the inside curtain, and fell back into the centre of the house), and the other on the outside of turret, bulging it in, and driving off the 1⅝-inch apron bolted on to the inside to keep in place the gun-rails, and down the main trace of turret. The bolt-heads flying from the inside of pilot-house at the same time, struck down pilot; Mr. Sofield, twice struck and senseless; and the quartermaster, Edward Cobb, helmsman, fatally injured with fractured skull, leaving me alone in the pilot-house, the steering-gear becoming at the same time disarranged. We were within 500 yards of Fort Sumter, unmanageable, and under the concentrated fire of, I think, one hundred guns at short range, and the obstructions close aboard. But fortunately we got the preventer steering-gear in working order in time to prevent disastrous result; and getting my vessel once more under command, I endeavoured to renew the action; but, after repeated futile efforts to turn the guns on to the fort, I concluded to retire for a time from close action, and endeavour to repair damages. At this time the squadron commenced retiring from action, in compliance with signal, and we permanently withdrew, having been about forty minutes in close action, during which we were struck thirty-six times heavily, had one man fatally, two severely, and four slightly injured, all by flying bolts and iron inside of turret and pilot-house; and we received the following injuries to the vessel and fittings, besides those already enumerated: the plates on side armour broken badly in several places, and in one, were struck by two shot in close proximity, partly stripped from the wood, and the wood backing broken in, with edging of deck-plates started up, and rolled back in places. On port quarter side armour deeply indented, and started from side and extremity of stern. The deck is struck twice damagingly—one shot near the propeller-well, quite shattering and tearing the plating in its passage, and starting up twenty-five bolts; another starting plate and twenty bolts; another starting plate and twenty bolts; and slighter blows are numerous. In smoke-stack armour there are three shot marks—one that pierced the armour, making a hole 15 inches long and 9 inches broad, displacing grating inside, and breaking seven bolts. In the turret there are marks of nine shot; fifty-six of the bolts are broken perceptibly to us, the bolt-heads flying off inside of turret, and the bolts starting almost their length outside, some of them flying out completely, and being found at a considerable distance from the turret on the deck. Doubtless many others are broken that we cannot detect, as by trying them we find others loosened. One shot struck the upper part of the turret, breaking through every plate, parting some of them in two, three, and four places. In pilot-house there were marks of six shot, three of them 11-inch; twenty-one of the bolts were broken perceptibly, and others evidently started. The plates are also much started, and the pilot-house itself, I think, much damaged and wrecked. Indeed, it is my opinion that four more such shot as it received would have demolished it. One shot at the base broke every plate through, and evidently nearly penetrated it; both flag-staffs were struck, but were not entirely shot away, and the ensign remained flying throughout.

"In making this minute detailed report of the damaging effects of shot upon this vessel, I have been influenced by a wish to point out wherein weak points are practically shown to exist; and I will add, that this experience has proved in my mind, beyond a doubt, that to those above enumerated may be added all hatch-plates, anchor, well, and propeller-well plates, and the tops of the turret and pilot-house, as entirely inadequate to defend the place they cover from being entirely penetrated; and in the propeller-well, wherein the propeller would probably be injured, and the pilot-house, wherein is contained the wheel for steering, and where exists the only look-out for the guidance of the vessel, and the top of the turret, from which the iron would be driven in upon the heads of those fighting the guns below, the effect, necessarily, would be damaging. During the action we fired four 15-inch shell, 3½ 7·10" fuze, three 15-inch cored shot, four 11-inch shell, 10" fuze, and four 11-inch solid shot. * * * * * *

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"In conclusion, I have to state that it was not until the following day, at five P.M., that the turret was cleared sufficiently to be turned, although a corps of workmen, brought out from New York, and under skilful supervision, were present, and commenced work upon the damages early the following morning.

"I am, very respectfully, your obedient servant,

"JOHN DOWNES, Commander.

"REAR-ADMIRAL S. F. DUPONT,
"Commanding South Atlantic Blockading Squadron."

(*m.*) REPORT OF COMMANDER A. C. RHIND, COMMANDING U.S. IRON-CLAD *Keokuk*.

"UNITED STATES' FLAG-SHIP *New Ironsides*,
"Off Cumming's Point, S.C., April 8th, 1863.

"SIR,—I have the honour to report that I got the *Keokuk* under way at 12.30 P.M. yesterday, in obedience to the signal from the flag-ship, and took a position in the line prescribed in your order of advance and attack. At 3.20 the flag-ship having made signal to disregard her motions, I ran the *Keokuk* ahead of my leading vessel to avoid getting foul in the narrow channel and strong tideway. I was forced, in consequence, to take a position, slightly in advance of the leading vessel of the line, and brought my vessel under a concentrated heavy fire from Forts Moultrie and Sumter, at a distance of about 550 yards from the former. The position taken by the *Keokuk* was maintained for about thirty minutes, during which period she was struck ninety times in the hull and turrets. Nineteen shots pierced her through at and just below the water-line. The turrets were pierced in many places, one of the forward port-shutters shot away; in short, the vessel was completely riddled.

"Finding it impossible to keep her afloat many minutes more under such an extraordinary fire, during which rifled projectiles of every species and the largest calibre, as also hot shot, were poured into us, I reluctantly withdrew from action at 4.40 P.M., with the gun-carriage of the forward turret disabled, and so many of the crew of the after-gun wounded as to prevent a possibility of remaining under fire. I succeeded in getting the *Keokuk* to an anchor out of range of fire, and kept her afloat during the night in the smooth water, though the water was pouring into her in many places.

"At daylight this morning, it became so rough that I saw the vessel must soon go down. Assistance being sent me, I endeavoured to get the vessel round, and tow up, and in that effort, at about 7.30 A.M., she went down rapidly, and now lies completely submerged to the top of her smoke-stack. The officers and crew were all saved, the wounded having been put on board a tug a few minutes before the *Keokuk* went down. Owing to the loss of papers and the separation of officers and crew, I am unable to furnish an officers' medical report, but give, as nearly as possible, the casualties in the action of yesterday.

"Very respectfully, your obedient servant,

"A. C. RHIND, Commander.

"REAR-ADMIRAL S. F. DUPONT,
"Commanding S.A.B. Squadron."

(n.) CHIEF ENGINEER STIMER'S REPORT OF DAMAGES TO THE IRON-CLAD STEAMERS.

"GENERAL INSPECTOR'S OFFICE,
"413, Broadway, New York, April 14th, 1863.

"SIR,—I arrived in this city, having left the fleet off Charleston, S. C., on the 11th instant, and I beg leave to report to the Department some of the detailed facts connected with the naval attack upon Charleston, essayed by Rear-Admiral Dupont with his fleet of iron-clad steamers, which came especially within my province, as the general inspector of iron-clad steamers and harbour obstruction submarine shells.

"Previous to the attack, I recommended to the Admiral that two of the Monitor vessels should have attached to their bows one each of the submarine shells which had been furnished by the Department, and that these should precede the others and attack the obstructions, attaching to the rafts which carried the shells several grapnel hooks suspended by chains to explode any torpedoes over which the vessels were about to pass, with a view to exploding them before the vessels themselves should come into dangerous proximity to them. There appeared, however, to be a feeling of objection to these shells, arising from an expressed apprehension that they would either run into some of our own vessels, and blow them up, or, if fired as designed, against the obstructions, would recoil against the vessel carrying them, and sink it.

"I explained, to the best of my ability, the experiment I had tried with one of them in New York harbour, which proved how impossible it was that this latter event would happen, and urged their trial until I was informed that I was wasting valuable time in pressing forward something which it had already been decided would not be used. It is with exceeding regret that I am thus compelled to report that this powerful weapon, for which we have every reason to suppose the enemy was entirely unprepared, should not have been used in an attack which could have few hopes of success without it.

"One of the rafts which had been prepared to carry the shells was, however, attached to the bow of the *Weehawken*, with the prepared hooks attached to protect the vessel against torpedoes. This she carried in and out again in safety, having proceeded as far as the line of obstructions, stretching from Forts Sumter to Moultrie, would permit.

"Having been directed to remain outside of the bar during the fight, I witnessed the conflict from the deck of the Coast Survey steamer *Bibb*, at the mouth of the Swash Channel. The firing on the part of the enemy was very terrific. He was not only able to keep up a very rapid fire from his numerous guns, but I felt satisfied was using reckless charges of powder, which it was clearly wisdom for them to do. I therefore expected to find upon my visit to them at least an approach to the destructive results which had been obtained by the Chief of the Bureau of Ordnance in his experiments against iron targets in the ordnance-yard at Washington. I was, however, agreeably disappointed to find, upon my inspection of the Monitor vessels the next morning, that there were no clear passages through the decks, and no penetrations through the sides of the vessels or the pilot-houses. The blunt-headed shots had proved much less effective than round shot, not only in confining their injury to the indentation made more distinctly than is the case with round shot, but the indentations themselves were less than those made by the spherical balls. On the other hand, I found casualties had occurred which occasioned loss of life in one instance, and disabled guns in others, through faults of design, which only such experience could point out, and which, I think, can be entirely removed in the new vessels now building.

"In the case of the *Keokuk*, although I never believed her armature would withstand the shock of heavy ordnance at short ranges (*vide* my reports, dated June 30th, July 14th, and July 31st, 1862), I was rather surprised that it should have proved so easily penetrable. If the lesson which this should teach is properly received, the loss of the vessel will be a positive gain to the Government in preventing the construction of armoured ships of more than doubtful impenetrability to ordinarily heavy ordnance.

"Although the *Ironsides* was not built under my inspection, it may not be considered improper for me to compare in this report the effect of shot upon her solid forget plates, of four and a half inches thickness, with the laminated plates of five inches thickness, which protected the sides of the Monitors.

"This vessel was twice as distant from Fort Sumter as several of the Monitor vessels; the effects are not, therefore, strictly comparable; still, the difference in the appearance of the two descriptions of armature is very instructive, and should not be passed lightly over by the engineer. When the laminated plates upon the sides of the Monitors were struck severely, the indentations were deep, the bolts securing them to the wooden backing started loose, the entire plates bent and separated from each other to an extent which impressed the non-professional observer with the idea of great injury: but when the engineer examined them, with a view of judging how well they would withstand another blow of the same force upon precisely the same place, he perceived that the original power to resist shot has not been greatly reduced.

"On the other hand, the solid plates of the *Ironsides* were not so deeply indented; there appeared to be no disturbance of the plates by bending, but few bolts were started, and few persons other than the critical engineer could look closely enough to see that the plate was entirely broken through in a manner which would inevitably permit the passage of the second shot striking the same place.

"To the casual observer, therefore, the solid plates will have the appearance of having withstood the bombardment better than the laminated, but the unprejudiced engineer will perceive that the latter disposition of the metal is much the most effective in attaining the desired end.

"In consideration of the vast importance to our country that that stronghold of rebellion should be reduced, I take the liberty to express to the Department my firm opinion that the obstructions can be readily passed with the means already provided, and our entire fleet of iron-clads pass up successfully to the wharves of Charleston, and that the Monitor vessels still retain sufficient enduring powers to enable them to pass all the forts and batteries which may reasonably be expected.

"I am, very respectfully, your obedient servant,

"ALBAN C. STIMERS.
"Chief Engineer, United States' Navy.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington."

2.—*Admiral Farragut's Opinion of the Obstructions of Spanish River Channel and Choctaw Pass in the Upper Bay of Mobile.*

RECONNOISSANCE OF MOBILE BAY.

"FLAG-SHIP *Hartford*, W.G.B. SQUADRON,
"Mobile Bay, Aug. 16th, 1864.

"SIR,—I have the honour to report to the Department that yesterday I made a reconnoissance in the *Metacomet*, accompanied by the *Selma* and several gun-boats and light-draught iron-clads in the vicinity of Mobile, approaching within 3½ miles of the city. We discovered that the rebels had sunk the *Nashville*,* the vessel intended for an iron-clad, across the channel, completely obstructing it, with the addition of a row of piles guarded by forts. Until these obstructions can be removed, there will be no possibility of our reaching Mobile with any of our light-draught vessels.

"Very respectfully, your obedient servant,

"D. G. FARRAGUT,
"Rear-Admiral, Commanding W.G.B. Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington, D.C."

The removal of these obstructions under the heavy fire of the batteries Albert Sydney, Johnston, Buchanan, Choctaw Point, Gladden, M'Intosh, and the camel-tower, and iron-clad square batteries, would be an impossibility. This impossibility is best proved by the fact, that these obstructions, although a great impediment to the navigation of Mobile Bay, have not entirely been removed to the present day. The opening of a gap only 40 feet wide, through which a blockade-runner (the *Virginia*) proposed to escape, required fully forty hours, and yet not a single shot had been fired at the two steamers and the working party engaged in cutting off and removing the piles and sunken obstructions.

Neither Mobile nor Charleston, Wilmington or Savannah, could ever have been taken by a naval attack alone; the obstructions placed in the channels leading to those places formed an insurmountable obstacle to the progress of a fleet; and no iron-clad could have withstood the concentrated fire of the heavy batteries, that would have prevented the removal of any part of these obstructions.

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* The vessel sunk near the south-east corner of the obstructions was the *Phœnix*, not *Nashville*.

CHAPTER VIII.

THE only losses of ships sustained by a Federal fleet whilst passing Confederate batteries were caused by a vessel running aground, and remaining thus exposed to a heavy artillery fire, as in the case of the *Mississippi* and *Philippi;* or by a vessel striking a torpedo, as in the case of the *Tecumseh.* But sand-bars and torpedoes are, the ones natural, the others artificial, obstructions; and too much importance cannot be attached to this most potent element in coast-defence.

Having endeavoured to prove from actual facts the correctness of the principles contained in the preceding chapters, we close the first part of this treatise by giving the following:—

VIEWS OF REAR-ADMIRAL DAVID D. PORTER ON COAST-DEFENCE.

"FLAG-SHIP *Malvern*,
"Cape Fear River, N.C., Feb. 1st, 1865.

"SIR,—General Barnard has just visited the works lately captured here, and the impression made upon him by the new plan of defences adopted by the rebels, and the effect of naval fire on them, has been to modify the opinions that he has heretofore entertained, if not to change them altogether. He has requested me to write an official document to the Department on this subject, as he considers that the experience I have had in attacking forts of various kinds has enabled me to form a pretty accurate idea of their powers of endurance against the ships of the present day, and whether or not forts can be built that will stand a bombardment such as can be brought against them by our navy, or any other navy equal or superior to it. The matter is of so much importance to this country, that I unhesitatingly comply with the request of General Barnard, although it is with some diffidence I undertake to handle a subject that may bring my opinion in conflict with those of officers more able and better informed on such subjects than I am. What opinions I may give are derived from an experience of four years' fighting against forts of all kinds, from a sand-hill battery for twelve-pounders, up to the largest work that was ever built. I do not pretend to know anything about the theory or the rules which govern engineers in their different arrangements of stone, mortar, sand, and guns. I am afraid I shall startle some of their long-established convictions when I state that, in my opinion, we have no forts on our part of the continent which can stand the concentrated fire of heavy ships, Monitors and Ironsides combined. When the kind of ships enumerated can get within a mile of any works, and can bring to bear guns enough (say fifteen to one) to drive the artillerists from their batteries, the capture of a fort is a mere matter of time, and a short time at that, if a properly-equipped military force is combined with the naval attack. The running past a battery is a very easy thing when there is a straight channel and sufficient depth of water; and there is no fort in any of the waters of the north that cannot be safely passed, and (in military phrase) the 'position turned;' and no forts now built can keep out a large fleet unless the channel is obstructed. These are rather bold statements for a sailor to make, but I may somewhat satisfy the feelings of military engineers, when I state that ports can be built that cannot only resist, but can destroy, any ships attempting to pass them, although I doubt if any work could be erected that would prevent vessels, wooden or iron, from running by, without obstructions in the channel.

" So, after all, we cannot depend solely on forts to defend the approaches to harbours, and must, in the end, rely a great deal upon the iron floating steam-batteries to encounter vessels that might run past our shore-batteries. The result of the experience of this war goes to prove that no works of any kind yet erected can stand the fire of ships. The rebels, being thrown upon their own resources, and finding that their earliest efforts did not succeed, have adopted new plans, which give evidence of great engineering skill, but which have failed in every case to prevent heavily-armoured vessels from passing their batteries, and in most cases their forts have succumbed. Indeed, I know of no instance where troops and ships, properly combined, have attacked a land-work when the land-work was not taken.

" It has been the received opinion, up to a late date, that one gun on shore was equal to ten on board ship. This, no doubt, may be true so far as regards ten guns in a vessel and one gun in a fort; but the rule gives way when a very large number of guns are brought to bear on the fort, and there is a continuous bursting of shells and shrapnell, and showers of grape and canister, against guns *en barbette*, or men behind traverses. It has been the custom to arrange guns *en barbette* in continuous rows, at twenty feet apart, in batteries of ten, fifteen, or thirty guns, as might have been supposed sufficient to protect a place. These guns were placed without intervening traverses, which is even at this moment the case with all our sea-coast fortifications. It is very plain to any one who has had any experience, and has been exhibited during this rebellion, that our sea-coast works cannot be manned and worked against fleets, since, by the close contiguity of the guns, the necessary crowding of the gunners, and the absence of all kinds of defence, the destructive effect of shells is too great to permit men to stand by their guns, which would soon be disabled (even if they had traverses) by the cool, deliberate fire of Monitors and Ironsides, continued with 11-inch and 100-pounder rifles in wooden vessels. Even though forts may be protected by the best of traverses, shells fired at proper elevations must take effect on the battery, since, if it misses one gun, it must strike another; and if the fire is at all enfilading, the shell may take effect on several guns at the same time. As long as a gun is disabled, it matters little how it is down. There is one source of mischief to gunners and to guns, arising from the erection of sand-bag or earth traverses. In the first place, a heavy shell striking or exploding on a traverse, knocks the sand into the muzzles of the guns, and disables them as effectually as if they were dismounted. This happened at Fort Fisher, long before the guns were dismounted by our shells. In the second place, the sand-bags are thrown down on the circles, and prevent the training of the guns. They are also thrown upon the gunners, wounding them seriously, and burying them under the earth. I saw an instance of the kind at Fort Fisher, where a rebel was buried by a shell, with nothing but his head left above ground. A *barbette* battery must be very defective and vulnerable when the guns are placed within thirty feet of each other. The space should be at least one hundred feet, with high earthen traverses between the guns. That is supposing we still adhere to the new system of fortifications which has been found capable of resisting ships.

"There are points where forts could be built, as above mentioned, where they would be unassailable by ships; and Federal Point, where Fort Fisher stands, is one of those points. Had the engineer, Whiting, known anything of the hydrography of the outer bar, he would have placed his fort one mile inside of where he did build it. This work then would have been out of reach of any naval guns. His line would have extended from the sea inside of the bar to the river and swamp on the inside, rendering it perfectly impossible for an enemy landing there to turn either end of the fortified line. This line would have commanded completely the tortuous and shallow channel leading into Cape Fear River, and all the light-draught vessels on earth could not have entered there; neither could light-draught Monitors or any kind of vessels, except in peaceful times, and with an experienced pilot.

"Thus it appears that the most skilful engineers will make mistakes which the knowledge of an intelligent seaman would have corrected. It was our good fortune that the engineer, Whiting, was self-opinionated, or else knew nothing of the hydrography outside the bar near the fort, or else he never had formed an idea of what the concentrated fire of three hundred guns would be on the face of a work protected by traverses. The Confederates, however, by numerous contests with our fleets, have learned that the old system of defending forts is very defective. They began, at Hilton Head, by following the old arrangement, and were driven from their guns in a short time. They at once, on finding the system defective, went to work to scatter their guns in numerous small batteries, instead of having them all together; and at the same time increased the space between the guns not less than sixty feet, and protected them by high traverses, which also answered for bomb-proofs. At Fort Caswell, the rebel engineers have entirely ignored the arrangements of the United States' engineers, which were made at great expense, and all the improvements of modern times introduced (as it was supposed) as circumstances required. While the rebels have been steadily advancing in the science of building forts, or remodelling those that fell into their possession, we have not progressed in the like manner, from the fact that necessity, which is the mother of invention, never arose to put the intelligence of our engineers to work. Our frowning stone-works, with their guns all standing out *en barbette*, and with others looking through small ports, and mounted in enclosed casemates, gave a feeling of security, and seemed to bid defiance to the strongest foe; while, in fact, both these arrangements are glaring defects, and a most prominent evidence of weakness in our forts. There is not a fort in the United States, that I have seen, that could not be silenced by ships, if a sufficient number were assigned to the task; and the Monitors would in a very short time (unmolested by the fire which heavier ships would keep down) knock away the wall with their 15-inch shot, and the whole fabric would be in ruins. The fact that our forts have 15-inch or 20-inch guns mounted, and could sink a Monitor if they struck her, furnishes no argument in favour of the forts. On the contrary, those large guns, standing so high up and loading so slowly, are just the objects that naval gunners would delight to explode their shrapnell against; and, from my experience in naval gunnery, the third shell would kill every man at the gun. If these monster guns were placed in stone casemates, with shutters of thick iron outside, they would be very severe on ships, provided the stone wall would stand the blow of a 15-inch shot. To prove it, it is only necessary to put a block of the best granite under a trip-hammer of ordinary size. The 15-inch shot is equal to trip-hammer, anvil, bellows, and forge all thrown at the same time. The rebels seem to have comprehended at once the weakness of the works at Caswell, remodelled the forts entirely, keeping the old structure as a ground to work upon, securing the brick walls, inside and out, with sand-bags and other earthworks, against heavy shot; scattering the guns, and protecting them with huge traverses, as at Fort Fisher. It would have been a most difficult place to take. I do not think ships could have had any effect upon it, as it was entirely out of the reach of our nearest shot. The Monitors could not enter the channel, and had we attacked that place as was proposed by an engineer who was totally ignorant of the hydrography, we should have failed in the naval part of the operations. It was a land or siege operation altogether. The navy would have been most effective in landing troops, and covering them until they carried their approaches to within half-a-mile of the works. I mention Fort Caswell, as showing that the rebels could have secured themselves perfectly had they planted Fort Fisher a mile further back from the eastern beach. The question now is, what is the right system to be adopted in building forts? As I have seen every kind of fort that has yet been built attacked by ships (wooden and iron), and in no instance did the vessels fail to capture, or aid in capturing, the forts, General Barnard has requested me to express my views, and give the result of my experience. I do so with no desire to make myself conspicuous, or take a leading part in a subject which properly belongs to another branch of the service, and I only undertake to throw some light on the subject at the request of others.

"My first experience in fort fighting was when I was quite a boy, and while a midshipman in the Mexican navy. I belonged to a twenty-gun brig, mounting twenty-four (24) pound carronades. We attacked two Spanish brigs-of-war of superior force, beat them, and drove them, much crippled, in-shore, under a one (1) gun twenty-four pounder Martello tower. This one gun opened on us, cut us up severely, and we in turn were obliged to haul off. Here was one gun more than a match for ten (10) guns in broadside. The gun on the Martello tower was *en barbette*, but we had nothing but solid shot in those days, and could not have competed with the one gun if we had had twenty guns in action. My second experience was in the war between the United States and Mexico. At the siege of Vera Cruz, a large battery train was landed, and quite a number of mortars, which played upon the town without seeming to affect the determination of the troops. The Mexican guns were *en barbette*, and had no traverses; six or eight naval guns (8-inch shell guns) were hauled up by the sailors and placed in position. Good works were constructed of sand-bags by the army engineers, and the guns in them were somewhat protected by traverses. From the time these guns opened on the town, it was very apparent that it was a mere question of a few days whether the place would surrender. The Mexicans could stand the solid shot, but were driven from their guns by the navy shells.

"Had the ships gone into action at that time, which they should have done, they would have silenced the Mexican batteries in half-an-hour, but the old idea that two on shore were equal to seventy-four on board ship was universally accepted as true, and no one cared to go contrary to rule. I was in a small steamer at that time, the *Spitfire*, commanded by Captain Tattnall. After assisting with our shell-guns in bombarding the town, the captain took a notion to attack the Castle of San Juan de Ulloa. Quixotic as this may appear, one or two shell-guns on that little steamer so disturbed the gunners in that large castle, with its numerous guns, that the steamer was struck but once, and fired over seventy (70) shells into the fort and town at a distance of less than a mile. I was then struck with the exposed condition of *barbette* guns, and urged Commodore Perry to attack the fort with the ships, but was not listened to.

" All the ships would have taken the castle in less than an hour.

" My next experience with shell-guns against batteries was on the Tabasco River, in the steamer *Spitfire*. I attempted to run past a battery of seven (7) guns pointing down the river; the guns were in embrasures. One or two shells of ours exploding over the guns cleared out all the gunners, and, anchoring the vessel in the rear of the works, we threw in shell so rapidly, boarding it at the same time with fifty (50) men armed with cutlasses, we carried the works against a garrison of five hundred (500) men, who were driven from their unprotected guns by our shells. I made up my mind from that day that forts constructed on the present plan would never stand the fire of ships. With these early impressions upon me, I recommended in the early part of the rebellion an attack on the forts at the entrance to New Orleans, Forts Jackson and St. Philip. I consulted at that time with General Barnard, who furnished me with most correct maps and plans, and agreed with me in opinion that the forts could be taken by ships and bomb-vessels. All the guns of these forts that were of any use were *en barbette.* The few that were casemated were nearly on a level with the water, the fort having settled. The history of that event is well known. The mortar-vessels disabled Fort Jackson so that no ship was struck from that side, and the men at the exposed guns of Fort St. Philip were driven to shelter after a few broadsides of the vessels as they passed. The best resistance opposed by the enemy was from some rams and gun-boats, but they were soon demolished, and the ships passed up, having received no damage that would affect their efficiency. Here were two forts, mounting nearly one hundred (100) guns, that were passed by a squadron of wooden ships with shell-guns, where the enemy had strong currents on their side, and bad shoals to interfere with the progress of our vessels.

"It was, perhaps, one of the most difficult positions for ships to pass at night amid smoke, flames, and rams; and, in my opinion, settled the problem about steam-ships passing forts when there was plenty of water. In this instance only a fleet of well-constructed Monitors or powerful rams could have stopped the advance of our fleet. The enemy had vessels intended for that purpose, but they were too fragile to effect anything, and were all destroyed. New York at this moment is in a worse condition for defence than New Orleans was at that time, and a fleet of English vessels could enter New York harbour (despite all the forts) or any other harbour where obstructions cannot be placed in the channel.

"Obstructions and torpedoes are a better defence than our present forts. Soon after the taking of New Orleans I was ordered up to Vicksburg with the mortars to try and silence the batteries while Admiral Farragut's fleet passed by. The rebels had about thirty (30) heavy guns mounted at that time, which they had been permitted to mount without being troubled. They had all kinds of batteries, but most of the guns were *en barbette*, with low traverses.

"The mortars soon drove the gunners away, and when the ships passed up, they threw in such a shower of shells and shrapnell that no rebel could stand to his gun until the ships had passed. Here were thirty (30) guns on shore against forty (40) on board ships, and yet the ships passed up in safety, losing only a few men, and with little or no damage to the vessels. The same ships passed down again with a like result.

"After this I was ordered to the Mississippi squadron, and coöperated with General Sherman in his attack on Vicksburg. Here I found that the rebels had constructed forts of a different order. The batteries were scattered in all directions, and there were never more than two (2) guns in one place. They also had sand-bag traverses.

"Haines's Bluff, up the Yazoo River, was a strong place, mounting seventeen (17) heavy guns and some smaller pieces. We attacked it with the gun-boats to try its strength, and found it more formidable than we expected. Strong as it was, the men were driven from the guns, and could we have got a land force in the rear of the work it would have fallen.

"The guns were not protected properly on the front from our fire nor in the rear. Haines's Bluff finally fell on account of gun-boats approaching it in front and the army coming up in the rear of it. It could not have stood the combined attack for two hours. At Arkansas Post I met with a new kind of work an enclosed casemate covered with a double thickness of railroad iron, and port-holes only large enough for the muzzles of the guns to get through. The fort mounted eleven (11) guns, but only three (3) of them were nine (9) and ten (10) inch. I had nine (9) 9-inch and two (2) 8-inch (the smaller guns were seldom used) to oppose to this in iron-clad vessels. The enemy had put up their range marks at five hundred (500), seven hundred (700), and eleven hundred (1100) yards. I placed the gun-boats only seventy (70) yards from the fort, and in three hours every gun in the enemy's batteries was disabled or dismounted. The work here was done mostly by the gun-boats. The new-fashioned casemate turned out to be no better than the guns *en barbette.* They were perfect slaughter-houses, and were piled up with dead and wounded. Every shell that went through the port-holes killed and wounded every man in the close casemate, and those that went through the door-way killed the man, and the guns mounted *en barbette.* This proved to me most satisfactorily that guns in casemates were no better protected from shells than those *en barbette.* I was convinced that no such casemates (and they were the strongest that I have ever seen) could stand the heavy guns of a squadron. Our next operations were against Vicksburg, where we passed down in defiance of those heavy batteries of over sixty (60) guns, and even took some fragile transports with us, only one of which was lost. Little or no damage was done to the fleet of gun-boats, and we lost, all told, but fourteen (14) men. The guns in Vicksburg were still mounted *en barbette* with heavy traverses. We inflicted more loss on them than they did on us, and our move completely sealed the fate of Vicksburg, and cut the enemy off from his supplies by the river.

"In the course of that same week I attacked the heavy works at Grand Gulf with eight iron-clads. The guns in these works were scattered (thirteen of them) over a space of fifteen hundred yards. Five of them were at an elevation of 53 feet; the others were at an elevation of 109 feet.

"After five hours and a half fighting, all the guns were disabled except one. They were literally covered up in the earth, and after passing down and landing the army fifteen miles below, we went up and took quiet possession of them.

"All these guns were mounted *en barbette* and the gunners could not stay at them; and although they fired well, and did us a good deal of damage, killing and wounding seventy-five persons in three vessels, they had to succumb. When General Grant made his attack on Vicksburg, in May, I attacked the lower batteries with six iron-clads, commencing at the lowest battery. We silenced the hill batteries all the way up to a nine-gun water-battery, which gave us some trouble, but gradually slackened its fire; and after an action of six hours we withdrew to fill up with ammunition, with only one or two killed and seven wounded, having disabled some of the heaviest guns the enemy had. The enemy's guns were still *en barbette.* The next fort I made a demonstration against was Fort Du Russy, on Red River. This work was taken by assault by the troops, a few men only being in the fort, and the gun-boats throwing only three shells over the water-batteries, which set the rebels to running. I examined this fort carefully. It was an extensive and beautiful structure, with a large square work, nearly a mile from the water, and heavy casemates, covered with two thicknesses of railroad iron. These port-holes in the main casemate were of thick iron, and only large enough to admit the muzzles of the guns. The embrasure inside was the reverse of embrasures generally. The guns were mounted on pivot carriages. I ordered the *Essex* to fire on this work, at a distance of 550 yards, to test its strength. A percussion-shell was the first one fired. It struck a point near the port-hole, and tore out the iron over a surface twelve inches long (vertically) by eight inches wide. I annex a drawing of the other damages, which shows that twenty shot would have knocked the whole work to pieces. It was not as good as guns *en barbette.*

"In a number of smaller affairs on the Mississippi and Red Rivers, in which the vessels of my command, with one or two exceptions, came off victorious, I was satisfied that no works yet constructed could stand the concentrated fire of heavy guns on board ship. The vessels have a great advantage; they can engage or not, as it suits them. They can choose their distance or position, and the fort has to accept the terms, or else the people on shore must go into bomb-proofs, and be captured finally by a land force. In no instance during the war, except at Charleston, have combined attacks of army and navy failed to take a fort, which shows conclusively that they were not properly constructed, and were made to be taken. The result of the late attack on Fort Fisher by the navy has been witnessed by Major-General Barnard, and I think he is somewhat surprised at the destructive effect of the naval fire on these tremendous works. It has, I believe, convinced him that we must make a new move in fortifying our coast, for the rebels have certainly exhausted all their ingenuity in holding sea-coast defences, and have never kept us out yet when we determined to get in.

"Fort Fisher is a stronger work than Fortress Monroe, against ships, although it is weak against an assault when the assault is covered by the fire of ships.

"The same fleet we used at Fort Fisher would silence Fortress Monroe in a day, dismount all the conspicuous guns, and the Monitors and Ironsides would demolish all the casemates in a few hours.

"The assaulting of such a work would be a more difficult matter, and could only be done by slow approaches and after a long siege. To show the importance of making a fort impregnable against shells or assault, which can be done, it is only necessary to read the history of the fall of Fort Fisher. It is certainly the strongest and most complete single work I ever saw, but it had the fault of being placed too close to the sea, where ships could get near it. It commanded all the works on Federal Point, and when Fisher fell, they fell also. There was no escape for one of the garrisons even.

"With Fisher fell Fort Caswell, Fort Shaw, Fort Campbell, the extensive works on Smith's Island, a heavy work at Smithville, and some minor works, in all amounting to 185 guns, with immense quantities of munitions of war. Fort Fisher was the key to all this tremendous system of works, which will furnish food for study to our engineers for years to come, and in many cases the plans inaugurated by the rebels will be adopted by us.

"I hope that we may never commit the same mistake that the rebels have, and build a fort without consulting the hydrography of its approaches. Here was a chain of works, not exceeded by anything of the kind in the world, lost to the rebels because the key to them all was placed within the reach of ships. Had Fort Fisher been built a mile further back, Wilmington could have defied us as long as the rebellion lasted.

"Our success might have been greater had we been provided with a sufficient number of troops to push right ahead. The gun-boats could do nothing, as the river was filled with obstructions commanded by heavy batteries. The troops, however, could not move, nor were they in sufficient numbers to do so. There was not a horse or a wagon in the whole army, and, in my opinion, there were not troops enough to hold securely a position of so much value to us. As it would take too much time and space to give a description of Fort Fisher and the adjacent works, I leave it to the abler pen of General Barnard, who has carefully examined them all. I am sure the result of his inspection has materially changed many of his views.

"Now comes the question, how are we to arrange our coast defences to make them serviceable? The theory heretofore accepted, that 'one gun on shore is equal to many on ship-board,' is found not to be true. Since the introduction of iron-clads, this idea cannot be maintained, as we now know how to construct vessels that will resist the impact of 9, 10, 11, 13, and perhaps 15 inch shot, and the guns of which can be worked in perfect security.

"The result of the firing of the iron-clads and Monitors upon the land front of Fort Fisher shows that even where *barbette* guns are spaced 90 or 100 feet apart, with high traverses between them, the protection to the guns is not sufficient, and that some more satisfactory arrangement of *barbette* guns than has yet been contrived is desirable.

"It is on this point that I wish to offer my opinion, which

I do with all due deference to the opinions of military engineers, who, no doubt, have their own views on the subject. In short, I propose that all our works shall be earthworks, or that those now built shall be covered with earth, the guns to be mounted in monitor turrets as they are now mounted in our Monitors. It is very evident that any thickness of iron can be used on the turrets, and any size of guns employed. The turrets can be placed in such proximity that no assault could be ventured; for with powder alone an assaulting party could be blown to perdition. Even if a party of assaulters should pass inside the Monitors, it could accomplish nothing, as the turning turrets would sweep them from the face of the earth. The galleries under the turrets could be so arranged, and made secure against an assault, by having central turrets inside the works, that every man of the enemy that ventured there would be destroyed. The details of this plan I leave to abler minds than mine, but I am sure that this is the only method to build a fort that will resist successfully ships and assaults. To prevent the passage of such batteries as I have mentioned by heavy ships-of-war, it will be necessary to have inside floating batteries of Monitors and Ironsides, and when we have all these, we can secure ourselves against the attack of every foreign power; but not until we have reached this perfection in forts can we stop a fleet of heavy wooden vessels. Foreign powers have learned by our successes, and will be apt to turn against us the experience they have gained.

"Fortunately, the navy will be amply supplied with Monitors, and it rests with the army to perfect its part of the defences.

"The value of fortifications on land is not in the least diminished by the late results; their importance is greater than ever, but they must be properly built.

"If a cheaper method than the one I have proposed can be adopted, and as good a one, I hope it will be tried.

"If stone casemates can be substituted for iron, or if those now built can be protected against 15-inch shot, I hope it may be done; but I would prefer seeing the experiment tried on some of our stone walls before I should put my trust in them in preference to monitor turrets.

"I have the honour to be, very respectfully, your obedient servant,

"DAVID D. PORTER,
"Rear-Admiral.

"HON. GIDEON WELLES,
"Secretary of the Navy, Washington, D.C."

PART II.

"*Obstructions and Torpedoes form a better Defence than our present Forts.*"

REPORT OF REAR-ADMIRAL DAVID D. PORTER,
of Feb. 1st, 1865.

OBSTRUCTIONS, TORPEDOES, TORPEDO-BOATS, AND METHODS OF LIGHTING UP CHANNELS AND WATER-APPROACHES.

A.—ON OBSTRUCTIONS.

CHAPTER IX.

(*a.*) *Importance of Channel Obstructions.—*(*b.*) *The Nature of the Obstruction is determined by:—*(*c.*) *Demands a good Obstruction has to satisfy.—*(*d.*) *Obstructions to be prepared in time of peace.—*(*e.*) *Obstructions are divided into:—*(*f.*) *Position of Obstructions in relation to Shore-batteries.—*(*g.*) *Strength required to enable Obstructions to withstand the Momentum of Vessels.—*(*h.*) *Cost-price.*

(*a.*) *Channel Obstructions* being essentially an element of a purely defensive warfare, in the strictest sense of the word, distinguished navy officers of great maritime powers have opposed them, for the weighty reason that any obstruction placed in the channel must necessarily more or less interfere with the free operations of their own fleet, which by them is justly considered the most natural agent in coast defence. And certainly nothing could be more logical than that there exists no necessity for channel obstructions, as long as there is a fleet strong enough unassisted to cope successfully with that of the enemy. But under circumstances of such favourable nature, the enemy, even without the assistance of costly fortifications, would be driven back before being able to effect his approach to the shore.

A second case presents itself. Whilst it would be reckless for a squadron to advance towards a greatly superior enemy, and give him battle beyond the range of the shore-batteries protecting the entrance to the port, the number of iron-clads composing this squadron might be sufficient to form an obstruction capable of keeping the enemy's fleet, should he attempt to force a passage, under a heavy, concentrated fire of both batteries ashore and afloat. In this instance, the iron-clads would serve as an obstruction, and therefore a further channel obstruction would hardly be needed. Yet there is not always sufficient space in or near an entrance to a port with advantage to manœuvre a strong flotilla of such floating-batteries. They then are in the way of each other, cannot bring their guns to bear on the enemy's ships, and collisions occur, as was the case in the Confederate flotillas stationed, under Captains Mitchell and Montgomery, near Forts Jackson and St. Philip. An attacking fleet, on the other hand, needs but a narrow front under such circumstances. Admiral Farragut's favourite plan of attack was, either to form in two divisions—as in passing the batteries of Forts St. Philip and Jackson, when the fleet was exposed to a heavy fire from both banks of the Mississippi River—or to lash his ships in couples together, form a closed-up line, steam ahead, discharge broadside after broadside when abreast of the shore-batteries (mostly using shrapnell and grape, to prevent the artillerymen from working their guns), and go, after having passed the shore-batteries, in pursuit of the floating batteries opposing his further progress—as in passing the batteries of Fort Morgan.

The Federal attack would not have succeeded—nay, it would even have resulted in disaster to Admiral Farragut's fleet—had it been possible to obstruct the channel between Fort Morgan and the eastern bank.

In no single instance during the North American war did a naval attack succeed where the channel had been obstructed; and in no single instance did it fail where the channel had remained open. Therefore, whenever the fleet alone, or shore-batteries and a strong flotilla of iron-clads, with abundant space to manœuvre in, combined, are not able to force the enemy to retreat, channel obstructions are indispensable.

(*b*.) The Nature of an Obstruction is determined by the following points:—

1. Depth and width of the channel.

2. Character of the bottom; whether firm or soft, offering a good foundation or not.

3. Current, ebb and flood.

4. Prevailing winds, or winds prevailing at certain seasons, and the sea caused by them.

5. Shape and nature of the shore or banks.

6. Quality of the water, whether fresh or salt. In the latter case, consideration on the effect of sea-worms has to be taken.

7. Changes the average level of the channel is subjected to. For instance, spring tides, ebb and flood; or, in streams, high and low water.

8. Influence of the obstruction on the direction and velocity of the current; and the effect produced by a change therein.

9. Drifting with ice and driftwood.

10. Draught of the vessels by which an attack may be anticipated.

11. Is the obstruction to be a provisional or permanent one?

12. Is there a gap required, allowing vessels to pass in or out, or may the whole width of the channel be closed?

13. Time, material, and labour at the disposal of the engineer in charge.

(*c*.) Demands which a good obstruction should satisfy:—

1. Its strength must resist the shock produced by the enemy's vessels running or butting against the obstruction.

2. It must not hinder the national fleet from passing in or out; wherefore a gap is required that may be closed or opened at will.

3. It must, to the least possible extent, interfere with the general features of the channel.

4. It must allow flakes of ice or drift-wood to pass without causing an accumulation of either above. An accumulation of drift-wood has, during the late North American war, repeatedly had a most fatal effect on the obstruction by which it had been caused. For instance, a raft on the Yazoo River, after having resisted for several months all efforts of a Federal squadron to pass, broke in consequence of the enormous pressure exerted against it by the drift-wood, which, not able to pass, had accumulated above the raft.

5. Its length must be calculated according to ebb and flood, or, in rivers, to a rapid rise or fall.

6. The obstruction should be fire-proof.

7. It should offer to the enemy an object impossible to be destroyed by the fire of his artillery.

8. It should be proof against the destructive effect of sea-worms.

9. If a floating obstruction, it should be flexible, and yield to the waves without losing in strength.

10. In this case, it should also yield to the first momentum exerted by a vessel running or butting against it, but by the gradual drawing together of its single parts render all further progress of the vessel impossible.

11. Its cost-price should always be in proportion to the importance attached to preventing the enemy from forcing a passage.

(*d.*) Obstructions are to be prepared in time of peace. A deviation from the maxim, "In time of peace prepare for war," appears here the less admissible, as, in conjunction with the principles developed above, the following points are certainly entitled to consideration.

1. The time which, after a declaration of war has been made, suffices the enemy for the concentration of a powerful fleet of steamers, with which to threaten any given point on our coast, does not suffice for the creation of a reliable channel obstruction.

2. The immediate presence of a blockading fleet, or fleet of observation of the enemy, renders it often an impossible, but always a most difficult, matter to establish a good channel obstruction.

3. If compelled to effect a channel obstruction *à tout prix*, and in the least possible time, the engineer will have to use such means as are most easily accessible; and hereby the object is seldom attained in the most reliable way, and certainly never in the most economical manner.

4. In many localities, the material required for an obstruction of the channel cannot be had, and to procure it from a distance, time would be wanting.

5. The establishment of any obstruction requires a number of labourers, who, after the outbreak of a war, could be otherwise employed to greater advantage.

6. The difficulties opposing the establishment of a channel obstruction often are very great. There are strong and changing currents, great depth of water, a heavy sea, bad bottom, and many other difficulties, that will contend against the engineer, and which should induce him well to mature his plans before commencing the work. Such a deliberation frequently will develop the necessity of some preliminary work—for instance, abutments, driving of piles, &c.—without which it would be impossible to establish any kind of obstruction.

(*e*.) A system of channel obstructions proper may consist of:—

1. Obstructions resting on the bottom of the channel.
2. Floating obstructions.
3. A combination of these two systems, which will generally be used where a gap for the passing of vessels through the obstruction is required.

(*f*.) Position of obstructions in relation to shore batteries.

It is self-evident that an obstruction has to be laid within the range of shore or floating batteries; for, otherwise, the enemy would not only be enabled unmolested to proceed to the removal of the impediments opposing his progress, but also the obstruction would fail to fulfil a principal object—that of keeping the enemy's ships under a heavy concentrated fire of the batteries. The range obtained by artillery of modern times is such, that it will be necessary to advance fortifications to a considerable distance from the point which they are intended to protect against a bombardment. Although the depth of a channel does not always very considerably increase within the first four or five miles from a seaport, its width in most instances does; and, for this reason, the establishment of a good channel obstruction has to-day become a more difficult undertaking than it was only a few years since, when fortifications erected at a distance of three miles from a place were considered a safe protection against a bombardment.

It is a well-known fact that shells, filled with Greek fire, were thrown into the city of Charleston from a battery called the Swamp Angel, fully 7000 yards distant. With the radius which it is now necessary to give to the circle described by the *enceinte* of a place, the difficulty of obstructing the channel will, in most cases, also increase.

Obstructions having as their object to keep the enemy's ships under a heavy fire, they should be placed so as to render this fire most effective. The stern steering apparatus and screw being, next to the deck, the most vulnerable parts of an iron-clad, the obstruction should, within short range, be placed above the shore-batteries. These, as has been proved in the preceding chapters, should have their guns and gun-detachments protected by strong iron casemates or turrets, with embrasures and gun-carriages so adjusted that the pivot-point of the gun be thrown in its muzzle-piece.

In most governments the attention of committees on heavy ordnance is at present directed to the question, in respect to the armament for shore-batteries, whether the rifled or the smooth-

bore of heavy calibre is most effective against heavily-plated vessels. Each opinion has its warm advocates. American artillerists and engineers, however, would give the 15-inch smoothbore the preference over all other pieces for the armament of batteries built to enfilade obstructions within close range.

(*g.*) The force with which a vessel may run or butt against an obstruction is determined by its weight, and the speed which it attains before striking.

The tendency of the shock will be to push aside, to submerge, to crush, to stretch, or to cut the material of which the obstruction is composed. Therefore, the vessel in striking will perform a certain amount of mechanical labour; and the greater the power of resistance of the obstruction, the greater will be the amount of mechanical labour to be performed by the ship attempting to pass. But, as long as the force required to perform this labour is equal to one-half of the force of the vessel in motion, the vessel will not be able to overcome the resistance offered.

The strength of an obstruction does not depend alone on the materials used, and the way in which they are joined together, but, moreover, on the manner of anchoring the whole structure. For this reason, obstructions which are sunk, or which are formed by driving piles into the bottom of a channel, generally offer a better prospect of a successful resistance than floating obstructions, which require abutments and strong anchors to hold them in their place.

(*h.*) The cost-price of an obstruction will increase with the depth and the width of the channel, and also depend on the nature of the obstruction best adapted for any special locality. It will, however, be impossible to thoroughly obstruct a channel without expending considerable sums of money. After the necessity for an obstruction has been once recognised, the engineer in charge should be furnished with all the requisites for making his work a strong one. An imperfect obstruction is in reality worse than none at all: it gives way to the first attack enemy would not only be enabled unmolested to proceed to the removal of the impediments opposing his progress, but also the obstruction would fail to fulfil a principal object —that of keeping the enemy's ships under a heavy concentrated fire of the batteries. The range obtained by artillery of modern times is such, that it will be necessary to advance fortifications to a considerable distance from the point which they are intended to protect against a bombardment. Although the depth of a channel does not always very considerably increase within the first four or five miles from a seaport, its width in most instances does; and, for this reason, the establishment of a good channel obstruction has to-day become a more difficult undertaking than it was only a few years since, when fortifications erected at a distance of three miles from a place were considered a safe protection against a bombardment.

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If a channel is long, it will certainly be judicious to establish several lines of obstructions, yet the work should always commence at the lower or outer obstruction, and not until this has been placed in condition to defy, with reasonable prospect of success, all efforts of the enemy to break through, no inner line should be commenced. Two weak lines are not sufficient for keeping the enemy's fleet off; and yet the labour, time, money, and material expended on them might, if concentrated on one single line, have rendered this one strong enough to prevent a most powerful fleet from passing.

CHAPTER X.

I.—ON SUNKEN OBSTRUCTIONS.

(*a.*) *Dams.*—If a channel of moderate depth has a good bottom, but few difficulties, other than those arising from obtaining the necessary material, will oppose the construction of a dam.

A work of this class, if properly built, offers the following advantages:—

1. Great strength.

2. Eligible positions for the establishment of turret-batteries on either side of the gap left for the passage of vessels of the national or a friendly fleet.

3. It serves as a good abutment for the floating obstruction, that may be held in readiness to close this gap at will.

Its disadvantages consist in—

1. Considerable expense of material, time, and labour, which is increased, if the structure is to be a permanent one, or is exposed to the action of ebb and flood, or a heavy sea.

2. The impediment it opposes to navigation.

3. Its tendency to modify the general features of the channel. The bulk and weight of sunken obstructions, and principally the large unbroken surface they oppose to the current, generally effect very soon considerable alterations of the bed and banks of the channel which is obstructed.

4. The difficulty of removing the obstruction after the necessity for closing the channel has passed.

The first of the disadvantages enumerated was weighty enough to prevent Confederate engineers from using this kind of obstruction very often during the late American war. One instance of its having been employed is presented in closing the approaches to Savannah. Rear-Admiral J. A. Dahlgren, in his report of January 31st, 1865, speaks of these obstructions as follows:—

"The heavy barriers that were laid across the Savannah River, at the head of Elba Island, have been found sufficiently difficult of removal, even when our possession enabled steam-tugs and divers to work without interruption.

"There was a double line of cribs extending entirely across; each of these was made of heavy timbers, 18 to 20 inches, stoutly framed together, with platforms at each tier, on which were placed piles of brick. Their tops were about level with high water, and in the different parts of the south branch must have had a height of 30 to 35 feet from the bottom.

"The party from the navy, consisting of a corps of divers and a steam-tug, were occupied two or three weeks in removing two or three of these, which opened a passage of not more than 100 to 125 feet.

"In the north branch, the divers who contracted effected a similar opening in less time, as the water was little more than half the depth of the south branch."

A very interesting example, from which it will be seen with what despatch a dam may be constructed, is furnished by the ingenious work executed by Lieutenant-Colonel Bailey, in the Red River, in Louisiana:—

General Banks, of the Federal army, had, in April, 1864, undertaken an expedition against the Confederate forces in north-western Louisiana, wherein he was supported by Rear-Admiral David D. Porter, who ascended Red River with a flotilla of twelve gun-boats and thirty transports. The issue of the battle of Mansfield, or Sabine cross-roads, April 8th, very suddenly compelled the Federal army to a retreat on Alexandria. The water, in the meantime, had fallen so low that Admiral Porter had scarcely any hope left of getting his vessels back over the falls at Alexandria, and his embarrassment was increased by the army making arrangements to evacuate the whole country. The iron-clad *Eastport* had already been lost near Grand Ecorce, and the abandonment and destruction of the whole fleet now seemed inevitable.

In this emergency, Lieutenant-Colonel Bailey, acting engineer of the 19th army corps, proposed a plan of building a series of dams across the rocks at the falls, and raising the water high enough to let the vessels pass over. This proposition looked like madness, and the best engineers ridiculed it; but Colonel Bailey was so sanguine of success, that Admiral Porter requested General Banks to have it done. Provisions were short, and forage almost out, and the dam was promised in ten days, or the army would have had to leave the fleet. General Banks placed at the disposal of Colonel Bailey all the force he required, consisting of some three thousand men and two or three hundred waggons. All the neighbouring steam-mills were torn down for material, two or three regiments of Maine-men were set to work felling trees; teams were sent out in all directions to bring in brick and stone; quarries were opened; and flat-boats were built to bring down stone from above.

The falls are about one mile in length, filled with rugged rocks, over which at the stage the water was then at it seemed to be impossible to make a channel. The work was commenced by running out from the left bank of the river a tree dam, made of the bodies of very large trees, brush, brick, and stone, cross-tied with other heavy timber, and strengthened in every way which ingenuity could devise. This was run out about 300 feet into the river; four large coal barges were then filled with brick and sunk at the end of it. From the right bank of the river cribs filled with stone were built out to meet the barges. All of which was successfully accomplished, notwithstanding there was a current running at the rate of nine miles an hour, which threatened to sweep everything before it.

The dam had nearly reached completion in eight days working time, and the water had risen sufficiently on the upper falls to allow three of the gun-boats (*Fort Hindman*, *Osage*, and *Neosho*) to get down and be ready to pass the dam. In another day, the water would have been high enough to enable all the other vessels to pass the upper falls. On the morning of May 9th, the pressure of the water became so great that it swept away two of the stone barges, which swung in below the dam on one side. Seeing this accident, Admiral Porter ordered the *Lexington*, still above the upper falls, to pass these, if possible, and immediately to attempt to go through the dam.

The *Lexington* succeeded in getting over the upper falls just in time, the water rapidly falling as she was passing over. She then steered directly for the opening in the dam, through which the water was rushing so furiously that it seemed as if nothing but destruction awaited her. She entered the gap with a full head of steam on, pitched down the roaring torrent, made two or three spasmodic rolls, hung for a moment on the rocks below, was then swept into deep water by the current, and rounded-to safely into the bank.

The *Neosho* followed next; all her hatches battened down, and every precaution taken against accident. She did not fare as well as the *Lexington*, her pilot having become frightened as he approached the abyss, and stopped her engines, when Admiral Porter particularly ordered a full head of steam to be carried. The result was, that for a moment her hull disappeared from sight under the water. Every one thought she was lost. She rose, however, swept along over the rocks with the current, and fortunately escaped with only one hole in her bottom, which was stopped in the course of an hour.

The two other gun-boats, the *Hindman* and *Osage*, both came through the dam successfully without touching bottom.

The force of the water and the current being now too great to construct a continuous dam of 600 feet across the river in so short a time, Colonel Bailey determined to leave a gap of

55 feet in the dam, and build a series of wing-dams on the upper falls. This was accomplished in three days' time; and by the 12th of the month, the whole fleet was saved.

(*b.*) *Sunken Vessels.*—In 1854, the Russians obstructed the entrance to the Bay of Tchernaïa by sinking most of the ships composing their Black Sea flotilla. The Confederates, in 1861, had no men-of-war thus to dispose of; but many a fine merchant-man, useful coaster, and swift-sailing fishing-smack were scuttled and sunk to form an obstruction in the approaches to Mobile and other southern sea-ports. The objections to such a course are obvious:—

1. The means of active defence are thereby weakened.
2. An obstruction of this class is the most expensive of all.
3. The amount of transportation is considerably lessened, a circumstance which has made itself very seriously felt during the late North American war. The engineers at Charleston, Savannah, and Mobile found themselves very often seriously embarrassed for want of suitable crafts in which to send building material, sand-bags, &c., to detached points with which communication was only possible by water.

This method of obstructing a channel should therefore be used only in case of the most urgent emergency. But if used, the vessels should be well filled with materials the weight of which will keep the sunken vessel in its place. Brick or brick-bats, sand, if protected against the action of the water, burnt clay and stone, are suitable materials for this purpose. (During the late American war, even pig-iron was often used for loading vessels that were to be sunk.) The vessels should also be fastened together by heavy cables, and should be cut down to the water's edge, else the attempts of the enemy to open a gap in the obstruction, by dragging or by blowing up one of the vessels, might have some chance of success. After the Federal fleet had passed Fort Morgan, the *Phœnix*, an unfinished iron-clad, was sunk near the north-east corner of the line of obstructions below Mobile, for the purpose of closing a newly-formed channel, which had here a depth of 13 feet, not sufficient to cover the deck of the vessel. The enemy, taking advantage of the first dark night, boarded her, placed several kegs of powder under her deck, and succeeded in partly destroying the value of the vessel as an obstruction.

It has also been proposed to sink, instead of valuable vessels, large pontoons, or enormous flats, built of strong timbers and planks expressly for this purpose. The pontoons or flats are to be held together by strong cables and braces, and are intended to form the foundation for a system of *chevaux-de-frise* constructed of iron. Such a system would naturally less interfere with the general features of the channel, as the force of the current would no longer be directed against a large and unbroken surface, as is the case when dams or sunken vessels are used for the obstruction of a channel. On the other hand, the construction of *chevaux-de-frise*, made of iron of sufficient strength to withstand the shock of a vessel, is so costly and so tedious, that it will always be possible to substitute some other system in their place.

(*c.*) *Rock.*—Large masses of rock thrown into a channel will form an excellent obstruction; yet the instances will be few in which the material required may be easily obtained. An obstruction of this kind had been proposed for the Potomac, below Washington city; and another instance is furnished by the plan of Confederate engineers to obstruct Cumberland River below Nashville, after the fall of Forts Henry and Donelson, in 1862, in this way. In the latter case, a few deep and heavy blasts would have sufficed to detach from the high and projecting river-bank such large masses of solid rock, that the narrow channel of the Cumberland would have been completely obstructed by them.

But where the material is not very convenient, and the locality very suitable for this kind of obstruction, the execution of some other plan will require less time and labour.

II.—OBSTRUCTIONS FORMED BY PILES, CHEVAUX-DE-FRISE, SAWYERS.

(*a.*) *Obstructions formed by Piles* may be advantageously used if the depth of the channel does not exceed 25 feet, and the nature of its bottom renders the driving of piles not an impossible or too tedious a work. Confederate engineers gave this kind of obstruction the preference over all others, wherever the depth of the channel would admit of its being used. The bottom of the channels consisting, in most instances, of mud followed by a stratum of sand, a method of placing piles was adopted which, though it may perhaps not be an entirely original one, is probably not generally known. To the boiler of the steam-boat loaded with the piles which were to be placed, a two-inch hose was attached; a valve rendered it possible to admit or shut off steam at will; the end of the hose not attached to the boiler had a long and strong nozzle fastened to it. A pile having been attached to this nozzle by means of a noose, the valve was opened; the steam rushed from the boiler through the hose and the nozzle, which was pointed on the surface of the water, and pressed the water aside. The pile was allowed to follow the stream of the steam till this had gradually reached the surface of the bottom, which, being soft, gave way to the pressure of the steam, by which a funnel-shaped hole was opened, into which the pile was made to slide. The steam was allowed to play until the funnel had reached a depth of four and even five feet, when the noose was detached from the pile and the valve shut. So soon as the pressure of steam ceased, the mud closed the funnel-shaped hole in the bottom around the pile, which stood now as firmly as if driven by a good steam pile-driver. This method of setting piles requires, besides the engineer of the boat, three men: one for holding and pointing the nozzle, and two for handling the pile. It is more expeditious than the ordinary manner of driving piles by at least one-third, and was also found more convenient, for the reason that it was not necessary to suspend work on account of a moderate sea, in which it would have been impossible to work an ordinary pile-driver. The whole line of pile-obstructions between the eastern bank and Fort Gaines (in the lower bay of Mobile) was thus set in an incredibly short time.

The piles most generally used for obstructions during the North American war were of yellow pine. They were always set with their bark on, and had a diameter of from twelve to fifteen inches, whilst their length varied with the depth of the channel. When placed, they were visible only in time of ebb or at a low stage of the water. There were three methods of closing a channel by piles:—

1. Two rows of piles were driven across the channel, the piles of the one breaking joints with those of the other, and almost touching them. At a distance of from four to five feet, two other rows were driven in rear of the first row; at the same distance another double row followed, and so on, till the breadth of the line was at last 25 feet. The space between each two double rows was now filled with any material that was convenient; in some instances, the distance between two double rows was increased, so as to allow the sinking of smaller vessels between them. (See Plate V., figs. 1 and 2.)

2. A number of rows were driven close behind each other; the piles again almost touching, and always breaking joints. Around the first rows strong chains were fastened, for the purpose of binding them firmly together; the piles of these rows were also often capped with ½-inch iron caps. A less number than fifteen rows of piles was not considered a safe obstruction. (Plate V., figs. 3 and 4.) In both these methods the gaps left in the lines of piles were to be closed by flats, loaded with brick, stone, &c., which were held in readiness for being sunk. Also floating obstructions and torpedoes[*] were intended for the closing of these gaps.

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[*] Although the torpedo, in connection with obstructions, will be minutely treated on in some of the following chapters, we remark here that obstructions gain considerably in value by having torpedoes, placed at every twenty feet, attached to them.

3. But inasmuch as continuous rows of piles, opposing to the current a large and unbroken surface, caused it to take another direction and flow with increased velocity, thereby washing out a new channel through the soft mud, a third plan for pile-obstructions was often adopted: diamond-shaped piers, containing a hundred and more piles driven closely together, were placed, at a distance of about 30 feet from centre to centre, in two and more rows and in *échellon* across the channel. The space between two rows was about 10 feet: in it floated a boom, constructed of long and heavy logs, which at one end was attached to one of the piers by a chain long enough to allow the boom to fall and rise with ebb and flood. Additional strength was given to this obstruction by a system of strong braces connecting the piers with each other. (See Plate V., figs. 5 and 6.)

The obstructions in the upper bay of Mobile consisted chiefly of piles, which, according to the locality, had been placed in one or the other of the methods above described. Their strength was hardly appreciated by even the engineer who had made the plan for these obstructions, till very serious accidents had happened to vessels which, in attempting to pass through the gap in foggy weather, had run on the piles. The Confederate gun-boat *Selma*, especially, was very severely damaged in this way. Admiral Farragut, as above mentioned, considered it impossible to take Mobile by a naval attack till these obstructions were removed.

(*b.*) *Chevaux-de-frise.*—Although the general plan of construction of *chevaux-de-frise* will hardly require any description, some kinds of this class of obstruction, which were used during the North American war, will not be without interest.

1. As repeatedly mentioned, the obstruction of the channel between Fort Morgan and the eastern bank (lower bay of Mobile) offered, in consequence of strong and changing currents, heavy sea, bad bottom, and great depth and width, considerable difficulties. Yet, an attempt to lessen the width of

the channel by placing several rows of *chevaux-de-frise*, commencing from the eastern bank, might have succeeded, had the nature of the bottom (quicksand) not rendered it impossible for any obstruction of this kind to stand.

Two logs, 40, 45, or 50 feet long, were, by braces, joined to a frame 6 feet wide. The first brace was placed 4 feet from the upper end of the logs, which were capped with a strong iron cap, in place of which a torpedo was used every 20 feet. (See Plate V., figs. 7 and 8.) Two of these frames were, near their upper ends, joined by a strong iron pin, and a chain attached to the brace, which was at about the middle of the frame. Five of these double frames made one section, and were connected by a strong chain. The section was launched, and floated to the point at which it was intended to be placed; here, heavy mushroom-anchors were attached to the middle of the chains connecting the middle braces of the frames; at a given signal, the anchors were simultaneously sunk, drawing with them the lower ends of the frames, which soon became embedded in the sand, whilst their upper ends opened like a pair of scissors.

Without having the strength of pile or sunken obstructions, the effect of these *chevaux-de-frise* on the bottom of a vessel attempting to pass would have been very severe. The length of the logs was so calculated as to bring their pointed ends, when placed, from 8 to 10 feet under water.

2. Railroad iron was, with good prospect of success, made use of in the following manner:—Two bars, 12 to 15 feet long, were placed, bisecting one another at right angles. (Plate V., figs. 9 and 10.) Into each of the four angles thus formed was fitted a piece of square timber, 8 by 8 inches. These pieces were firmly drawn together by strong iron screw-bolts. Two bars being placed every three feet, the weight of this contrivance was very considerable; therefore the sections were built separately in lengths of from 15 to 18 feet. They were constructed on board of flats, and towed to the point where they were to be placed.

Against a mere boat-attack this obstruction is excellent, especially if the timbers forming "the body" are protected against being sawed through by light iron bars. The difficulty of uniting the several sections into one strong whole is, however, so great,* as to render this obstruction, like all others of its kind, liable to the objection, that, although it may withstand the direct shock of a vessel running against it, it may be displaced by the vessel fastening a strong anchor and chain to it, and steaming off in an oblique direction to the line of the obstruction.

3. The importance of protecting isolated and not strongly garrisoned works against boat-attacks made itself felt already at a very early stage of the war.

For instance, an expedition, consisting of five boats and an armed crew, was fitted out, during the dark night of April 1st to the 2nd, 1862, from the Federal squadron then threatening Island No. 10. Battery No. 1, or Rucker (as it was also called, after its former gallant commander), lay about three-quarters of a mile above the main position on the Tennessee shore, being separated from it by a wide and deep slough. This battery was carried by the Federals, who, after having spiked the six guns mounted in the battery, withdrew with their boats uninjured. Figures 11, 12, and 13 of Plate V. present the plan for a simple and efficacious protection against a mere boat attack; the form designated by figures 14, 15, and 16 is, however, preferable, as no boat can pass over it without first submerging the logs and frise, and if turned upside down the obstruction still presents itself.

(c.) *Sawyers.*—American boatmen designate by this name large trees that, during high water, having been washed from the banks into a river, were carried along by the current so long as the stream was at a high stage; the water falling, their butt-ends gradually sunk to the bottom of the river, where by their roots they became firmly embedded in the mud, whilst their branches, pointing down stream, remain near the surface, and, by the current, are kept in that up-and-downward motion, which has given them their name.

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* If submerged, the work of connecting them could be performed by divers only.

These sawyers are exceedingly dangerous to steam-boats navigating the western rivers of the American Union, and are, especially on the lower Mississippi River, considered the cause of at least one-half of the numerous accidents to steamers that every year happen in these waters. Their removal is deemed important enough to cause the government of the State of Louisiana to keep a number of snag-boats constantly employed.

An engineer, who was familiar with the great danger of these sawyers, proposed the following plan, which was put into execution, for the obstruction of the Tombigbee River, near Owen Bluff, about 110 miles above Mobile. (Plate V., figs. 17 and 18.) A system of artificial sawyers was formed by joining long and heavy logs (according to the depth of the water, 40 and 50 feet long) into a frame. The logs were placed 30 inches apart in the clear. Four of them made one frame or section. These sections were fastened together by strong chains, and, having been floated to the point at which they were to be sunk, the boxes fastened to the lower ends of the logs were filled with rock, brickbats, &c., and ten or twelve sections were thus placed simultaneously. Three empty and water-tight barrels, fastened between the logs of each frame, gave sufficient buoyancy to the whole structure. Four lines of these obstructions were placed in this manner; the logs used in the construction of the lower line were capped with heavy iron caps; to every eighth log a torpedo was attached. The sections reached to within five feet of the surface at high water.

Although the strength of the obstructions at Owen Bluff has not been practically tested, their removal, after the close of the war, presented sufficient difficulty to prove that it would have been an impossibility for any vessel to open a gap in the line under the heavy fire of the near batteries. The efficacy

Plate V

Fig. 11

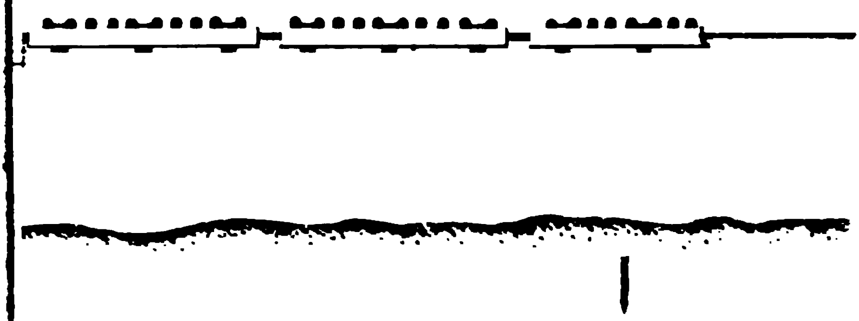


Fig. 12

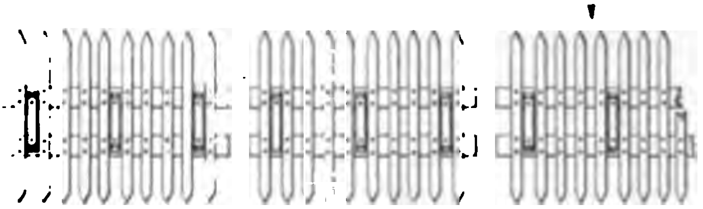


Fig. 13

Fig. 14

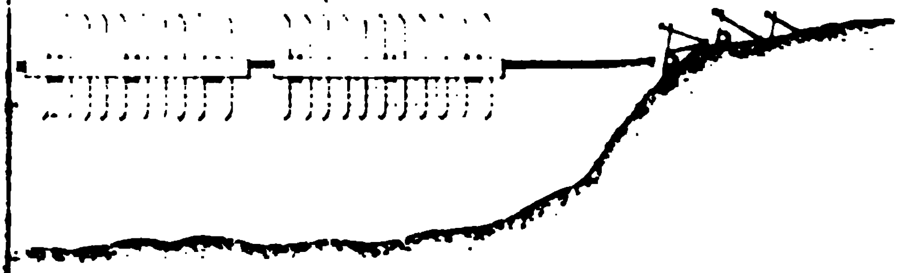


Fig. 15

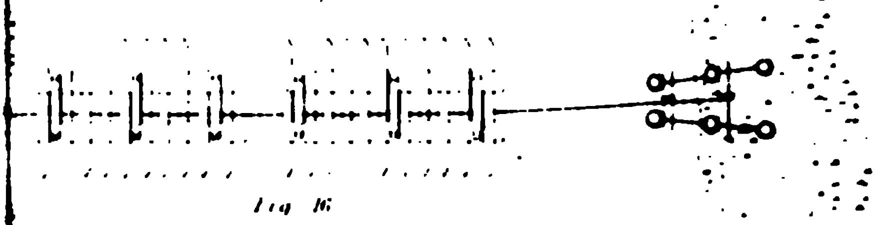
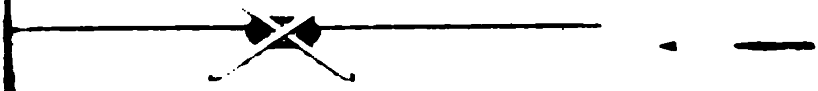


Fig. 16



of the system, however, has been often proved by the accidents happening to steamers navigating the Mississippi and its tributaries.

In a current, exposed to change with ebb and flood, sawyer-obstructions are naturally of no value; but in a constant current, as in a river above the point up to which ebb and flood are perceptible, they offer a most serious impediment to a vessel ascending the stream.

CHAPTER XI.

ON FLOATING OBSTRUCTIONS.

FLOATING obstructions offer several important advantages over those treated on in the preceding chapter:—

1. A floating obstruction may be established under circumstances that would render it impossible to use any other kind of obstruction; as, for instance, great depth of water, bad bottom, &c.

2. Presenting to the current a smaller surface than that presented by sunken obstructions, or by long rows of piles, they cause no important changes in the general features of the channel.

3. They are readily placed into position, and may be removed without difficulty after the necessity of obstructing the channel has passed.

The construction of a good floating obstruction, however, requires the solution of the following problems:—

(*a*.) The obstruction shall prevent the fleet of the enemy from passing.

(*b*.) It shall resist the effects of currents, winds, and waves combined.

(*c*.) Its cost-price shall be the least possible.

(*d*.) It shall not hinder the national fleet from passing in and out.

A subject of this importance could the less fail to attract the attention of distinguished engineers, as it presents difficulties which practically were not entirely overcome during the American war, and which since have been perhaps solved only in theory.

Experience having pointed out the advantages and defects of the different systems of floating obstructions that were used during the American war, we turn our attention to them before entering upon the description of two systems of more recent design.

1. *Chains and Booms*

Were, during the war, first used on the Mississippi River. A chain supported by logs was extended across the river near Fort Jackson. Admiral Farragut ordered a petard to be fastened to the chain, and thus opened a passage without great difficulty. A similar chain was intended to be placed across the river near Carrolton, ten miles above the city of New Orleans; it consisted of ninety-six sections, each of them being constructed as follows:—Three logs, of 3 and 4 feet in diameter, and from 30 to 40 feet long, were frapped together (Plate VI., figs. 1 and 2) by three and four layers of 1-inch chain. Through the opening remaining between the logs, a 2-inch chain was passed, by which the sections, placed at a distance of twenty-five feet from each other, were connected.

Near Columbus, Kentucky, a chain of the same construction was stretched across the Mississippi: it was carried away by a current of only four miles an hour, yet before the Federal gun-boats had made an attempt to pass. Although these obstructions had resulted so unsatisfactorily, booms were again used by Confederate engineers in their endeavours to obstruct the channel between Forts Sumter and Moultrie in the summer of 1862.

Each boom consisted of nine square logs, 12 by 12 inches, 20 feet long, connected together in three layers by an iron band at each end, and bolted with trenails. At a distance of 3 feet from each end of the middle log, in the bottom layer, an iron band went round it, to which was attached one large and three or four small links of chain. Through the bottom link was put the iron traverse that held the bar of railroad iron. Each bar had a large iron loop bolted into each end. The booms, as thus described, were connected together in pairs by a link through the loops. The pairs were then connected together into sections of twelve booms, a single shackle connecting each pair.

These sections were then moored across the channel, the first section towards Battery Bee was secured at one end by a large anchor, and the end in the direction of Sumter moored with two mushrooms. The second section was then shackled on, and the end secured with one mushroom; the third section with two mushrooms; the fourth with one, and so on, alternating in making use of one or two anchors. (Plate VI., figs. 3 and 4.)

Hog Island Channel, in the same harbour, was also obstructed by a boom of similar, but lighter construction. A chain of $\frac{3}{4}$-inch iron was floated by blocks of timber, consisting of four four-squared logs, 12 inches by 12 inches, and 15 feet long, kept together by an iron band at each end. Railroad-iron bars were again suspended from these blocks, and shackled as above.

This plan of constructing boom-obstructions did not prove more successful than that adopted for the obstruction of the Mississippi River. Whole sections of the boom were washed away during the winter gales of 1863, and floated down the channel. The enemy hauled them up on the beach of Morris Island, and secured within a few days as many as thirty-three sections.

But even had the Confederate engineers succeeded in anchoring these booms firmly in their position, the obstruction would not have prevented a vessel from passing: the boom would have been broken by the first shock of the vessel, or it would have resisted. In the first case, a passage would have been opened at once; whilst in the latter case, one of two alternatives would have taken place—viz., the vessel would have pressed the chain, or part of the chain, and a float under her bottom, and passed over, like a steamboat passes over a log drifting in the Mississippi, or the whole line would have been dragged along by two and more vessels pushing simultaneously against it, till at last it would have broken, or been displaced in a way which would have been equivalent to the opening of a gap, through which other vessels of the fleet might have passed, without danger of meeting any further obstruction.

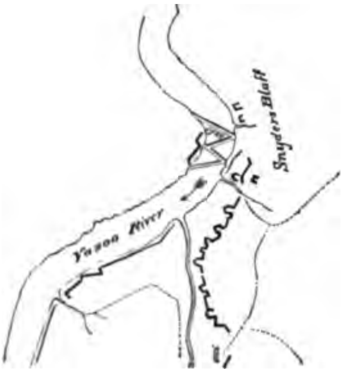
The upper surface of an obstruction of this kind is too narrow, to grant any possible hope that a vessel running on it should be prevented from working her way over the boom. Instead of one single line, two and more lines of boom might be placed and connected by strong chains with each other. The width of surface and the strength of the obstruction would thereby naturally be increased in proportion. But under no circumstances could too much stress be laid on firmly securing the end sections of the boom, next to the shore or bank, by stout cables to strong abutments. The floats should be anchored, so that instead of laying across the current, presenting to its pressure a comparatively large surface, they should float parallel with it, presenting only their pointed ends to the current, against which the pressure would be less. (Plate VI., fig. 5.) Torpedoes and rope-obstructions (see No. 3 of this chapter) should be used in connection with the boom.

2. *Rafts.*

A broad and solid float, stretched across the width of the channel, like a huge flake of ice, firmly secured in its position, and combining enormous strength with great buoyancy, would, as far as the mere condition is concerned, of offering resistance to the shock of a vessel, form the most excellent obstruction of all that could be devised. Recognising the correctness of this theory, Confederate engineers often made use of large-rafts for the obstruction of channels. These rafts consisted of square hewn timbers, 12 inches by 12 inches, of such lengths as could be conveniently obtained. The timbers were placed in three and four layers, one on the other; the timbers of each layer were firmly joined together by long 1½-inch oaken trenails, and in the same way also to the timbers of the layer on which they were placed. The timbers of one layer always broke joints with those of the other, and were generally laid diagonally on them. The raft varied in width from 20 to 25 feet; strong iron clamps were used to hold the several layers more firmly together, also 1-inch iron bars placed under the bottom and on the top layer of the raft, and drawn together by iron screw-bolts. The side of the raft facing in the direction from which an attack was to be anticipated, was in addition protected by heavy iron bars. Rafts, 600 and even 800 feet long, were thus constructed, and placed across the channel of rivers, which, although flowing with a strong current, and being subjected to a sudden rise or fall, had not motion enough to cause waves. The raft was held by cables, which were anchored into strong piers.

Of all the obstructions of this class, constructed during the whole course of the American war, there is not a single one that has withstood the pressure of the current and of the driftwood which had accumulated above it. The raft intended for the obstruction of the Alabama River at Choctan Bluff broke even before it had been placed into position. It contained over 90,000 cubic feet of timber, and its construction had occupied 2500 hands and a corresponding number of four-mule teams from the month of December, 1862, to the month of March, 1863.

The raft constructed for the obstruction of the Yazoo River at Hanye's Bluff, not far from Vicksburg, was the only one of all constructed during the course of the war which did not give way to the current, even before a Federal fleet came in sight of the obstruction. It consisted of four parts, bracing each other as indicated in the annexed figure.



At last it also yielded to the pressure of the driftwood that, unable to pass through the obstruction, had accumulated above it.

From what has been thus far said about booms and rafts, two deductions may be made: in the first place, both kinds of obstruction require a more thorough method of anchoring than the Confederate engineers made use of, or had the means for using; and, in the second place, they require an opening through which driftwood may pass freely.

The question that arises next is, will it be possible to join the timbers of a raft so firmly together that the whole structure will have sufficient strength to withstand the action of heavy seas without being gradually torn asunder by the waves?

A raft built in Canada was safely floated across the Atlantic Ocean; the waves broke it to pieces only after it had already entered the English Channel. This fact certainly speaks for the strength it is possible to give to a raft.

In looking over the lists of accidents that happened to steamers on the Mississippi River, we find that a number of boats, among them several very stoutly built, and of 3000 and more tons capacity, were most seriously damaged, and even sunk, by colliding with rafts that were coming down the river, or had been tied up to the bank for the night. The raft itself was in no case seriously injured by the collision. All these considerations have induced American engineers to judge rather favourably of the plan to use rafts as channel-obstructions. They propose, however, several most important modifications in the plan described above.

1. One large raft, placed across the whole width of the channel, does not only prevent the passage of drift-wood or of flakes of ice, but, what is more important, closes the channel to the national fleet as well as to that of the enemy. It is obvious that to change the position of a body, exposing to the pressure of the current as large a surface as that of such a raft, would be most difficult, if not in most cases impossible. The raft might be moved with the current, and an opening of sufficient width be formed to allow the fleet to pass; but the re-closing of this gap would require an amount of power, which, to say the least, might be more advantageously employed.

For this reason American engineers advocate the plan of closing the channel only partially, by placing several rafts, resting against abutments or piers, in position, and holding other rafts more easily moved in readiness for closing or opening at will the gap which had been left in the obstruction.

2. Floating obstructions, which have a narrow surface, may, as above mentioned in connection with booms, be submerged by a vessel running on them, and, causing but little friction against the bottom of the ship pressing the obstruction down, it may be passed by the vessel without much difficulty. This consideration seems to demand that the raft should be made of a certain width, for which American engineers propose not less than 100 feet. But as it would again be impossible with reasonable ease to move a raft of that width and of proportionate length, it is proposed to construct a number of much smaller rafts, to be connected by strong chains; the whole system covering a larger space on the surface of the channel than that covered by one single raft constructed of the same quantity of timber.

3. The construction of a floating obstruction stiff enough to resist the action of currents, winds, and waves combined, and also strong enough to withstand the repeated shocks of one or more vessels running against it, may be considered, although by no means a technical impossibility, as at least a financial one. The problem of establishing a floating obstruction at a reasonable expense of time, material, and labour can, therefore, be only solved by making the inertia of a floating obstruction not great enough to expose the obstruction to the full strength of the vessel striking it. In other words, it is claimed that the obstruction should yield to the first shock of the vessel, thus causing the blow to change into a push, the force of which would be gradually lessened by the single parts of the obstruction being drawn together, and stopping the further progress of the ship.

These small rafts are built of two layers of square timbers, 10 inches by 10 inches, or 12 inches by 12 inches; the length of the timbers is 15 feet, the raft being given the shape of a square. The annexed figure will explain the way in which the rafts, after having been connected by 2-inch wire cables 12 feet long, are placed in the channel. For a good obstruction of this class, five to six rows of rafts, anchored *en échelon*, are deemed indispensable, covering a surface of from 130 to 160 feet in width. Each raft is secured by its own anchor; the rafts of the two exterior lines, however, receive second anchors, which, on long cables, are placed some distance from the obstruction. Additional strength is given to the rafts composing the two rows next to the enemy's fleet by fastening frames of railroad iron around them. The necessary buoyancy is attained by providing the rafts thus protected with iron buoys.

3. *Rope-Obstructions.*

Admiral James Buchanan, when, long years before the outbreak of the American war, in the East Indies, was once for several days detained in a port, which he had been about to leave, by being compelled to have a cable removed, which, floating in the water, had been attracted through the suction created by the revolutions of the screw, and had become so firmly twisted around the shaft of the screw that the latter ceased to turn.

This and other cases of a similar nature being known, Confederate engineers frequently made use of rope-obstructions to bar a channel, the depth of which prevented the placing of piles, &c. They were principally used in Charleston harbour, where they contributed so much to the successful defence of that important port.

They consisted there of a line of buoys made of palmetto-wood, and rounded at both ends, thus rendering them nearly undiscernible at any great distance, and especially at night. To these floats or buoys was attached a 7-inch hawser by two heavy iron staples. The floats were about 20 feet apart, and at intervals were anchored with heavy grapnels. From the hawser, which was shroud-laid, hung down a lighter rope. The buoys were also made of yellow pine, 39 inches long and 15 inches in diameter. These obstructions were placed in sections of twenty-five buoys, the hawser passing through the staples being anchored at each end and in the centre. At the termination of one section, another, constructed and anchored in the same manner, commenced, till the whole width of the channel was thus filled. Two and three rows of these obstructions were placed at a distance of about 100 feet apart; therefore, if a vessel had succeeded in passing through one line, she would have had to pass another one or two still before being out of danger of fouling them. (Plate VI., figs. 6, 7, and 8.)

Although the Federal fleet did never again approach these obstructions after Admiral Dupont's first attack on Fort Sumter, April 7th, 1863, had failed, and their value, therefore, was not practically tested by the enemy's vessels actually coming in contact with them, some idea of what it really was may, however, be formed by the accidents that happened to Confederate vessels which came in too close proximity to them.

The side-wheel steamer *Ettiwan* drifted on the obstructions, and upon starting her engines the obstructions caught and stopped her wheels. The side-wheel steamer, *Chesterfield*, whilst steaming up against an ebb tide, got near the obstructions, and although she was some ten yards from them, they were drawn in on either side and stopped the wheels, until cut away, and the buoys were split to pieces. The *Palmetto State*, an iron-clad screw gun-boat, while going down the harbour, just after the United States' Monitor *Keokuk* had been sunk, caught the obstructions in her propeller, and had to anchor in order to clear the rope twisted around her screw-shaft.

One of the blockade-runners (a propeller) was going out of the harbour, when she caught in these obstructions, which stopped her engine, so that she could neither go ahead nor back, and had to be towed back to the city and put in the dry dock, when it was found that the rope had worked into the journal.

Like all floating obstructions, rope-obstructions require to be firmly anchored. The current presses with much force against the buoys, and the hawser and rope supported by them, and unless held fast by anchors, the great weight of which would at first appear to be out of proportion to the small surface presented by the obstruction, they will be swept away by the current, as was so often the case in Charleston Harbour and in the Bay of Mobile.

A great objection to rope obstructions is the ease with which they may be removed or cut by the enemy's boats during the night. Against this, vigilance seems the best defence; yet the hawser, to which the ropes proper are fastened, might be protected by telegraph-wire placed lengthwise around the hawser, whereby the "cutting operations" of the enemy would be rendered somewhat less expeditious. The objection, that the screw of a propeller might be screened by a shield or grate, through which the end of a rope floating near the surface of a channel could not enter, appears even less tenable: the screw, for working, requires a certain volume of water; this volume could not rapidly enough be obtained if the openings in the shield or grate protecting the screw were made so small that a 1-inch or ¾-inch rope could not find its way through them to the shaft of the screw.

A third objection has been urged: the ropes are brought in contact with each other by the current changing from ebb to flood; they become entangled, and are tied in knots, thereby causing the obstruction to lose much of its value. It cannot be denied that it would be next to an impossibility to keep the buoys of one section in an entirely straight line. The current is stronger at one point than at another; the nature of the bottom and the depth of the channel vary, all causing one or another of the buoys to drift somewhat out of place, whereby the centres of the semicircles are displaced, which the end of the rope describes in following the current from ebb to flood. The centres around which two or more ropes swing, are thus, perhaps, brought so near to each other that the ropes may become entangled. Yet the position of the buoys themselves indicate where such a displacement of centres has taken place; and one ebb or flood is scarcely sufficient to cause an entanglement great enough materially to injure the value of the obstruction. All obstructions, of whatever kind they are, require constant attention; and the injury sustained by a rope-obstruction may be easily detected and easiest of all repaired.

A last objection,—viz., that rope is twisted and worn by the action of the current, will be obviated if the obstruction is properly constructed: by marlining the ropes, and attaching them to the hawser by swivels, thus enabling them to follow all changes in the direction of the current, without being twisted.

The great value of rope-obstructions cannot be contested.

1. Their efficacy has been proved by experience.

2. They are of simple construction, are readily made and easily placed.

3. They may be prepared and be held in readiness for being used at any moment, without danger of being destroyed by rot or worms, if they are stored with ordinary precaution.

4. They can be placed anywhere where the bottom of a channel is firm enough to bear the weight of an anchor.

5. Of all floating obstructions, their cost-price is the least.

4. *Obstructions formed by a Combination of Rafts, Ropes, and Torpedoes.*

It is evident, from what has been said above, that each of these classes of obstructions offers peculiar advantages, and presents peculiar difficulties. And the question arises, whether it would not be possible in one obstruction to combine the excellences of all, and to a great extent to avoid their defects.

A combination of rafts, ropes, and torpedoes might be so arranged that each part would be complementary to the other, nor would the cost of such an obstruction be materially greater than that of the simpler methods above described.

We therefore propose such a compound obstruction, something like the following: —

(*a.*) *The Raft* has the shape of an equilateral triangle, the side of which has a length of 18 feet. The frame is formed of twelve square timbers, 12 inches by 12 inches; four of them forming one side, and being tightly drawn together by 1½ inch screw-bolts. (Plate VI., fig. 10.)

The three sides of the frame are joined together and braced, as indicated in figs. 11 and 13.

Iron caps, 1 inch thick, 24 inches wide, and as long, protect the three corners of the raft (figs. 12 and 13). They are let into the timbers so as to make the surface an even one.

The bottom and top of this frame may be covered with sheet-iron, rendering the spaces between the braces and sides water-tight (fig. 16), and therefore giving great buoyancy to the raft. To the bottom of the frame and near each corner a swivel and ring are fastened (figs. 14 and 15), through which the chain is drawn by which the frames are connected.

This chain is made of 2-inch round iron, and is 9 feet long.

The obstruction forms an arch (Plate VI*., fig. 18) springing in the direction of the enemy, and resting with its ends on strong abutments. It is composed of four rows of rafts, each raft being held by an umbrella anchor (Plate VI., fig. 19), and the two exterior and interior rows being, in addition, secured by anchors placed at a distance from the frames, by which the angle between the anchor-cable and the surface of the channel is not greater than 45°.

If the width of the channel is considerable, some intervening points of support, besides the abutments on or near the shore, will be required for the line of obstruction.

Such points of support may be established by building piers (iron piles or masonry) at a distance of 400 yards from each other; or, if the anchorage is good, by permanently anchoring large flats at the same distance apart, against the sides of which the obstructions may lean.

On these piers and flats iron turrets might be placed mounting one or two heavy guns each. Although the expense for structures of this class is very considerable, the advantages accruing from them are in proportion: great strength of the obstruction, and an enfilading fire, the effect of which no vessel could withstand. Each raft in the row next to the enemy has a friction-torpedo attached to it by means of a spar four feet long.

Such an obstruction, by reason of its composite character and mobility, would readily yield to the first shock of a vessel; but this shock would be immediately converted into a continuous push, the effect of which would be, according to the law of the arch, to increase each moment the resisting force of the obstruction, while the vessel must lose in speed proportionally to the gradual increase of the weight it has to push before it, till finally the motion is entirely overcome.

In addition to strength, the following advantages are claimed for an obstruction of this class:—

1. The line may readily be opened whenever an emergency for the passing in or out of vessels of the national fleet presents itself.

2. The obstruction does not interfere with the free passing of the current.

Plate VI

Fig 11

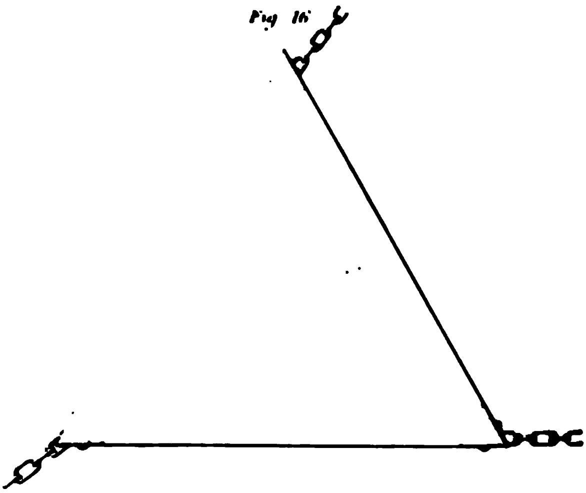


Fig 10

Fig 12

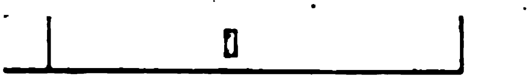


Fig 14

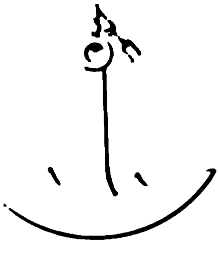
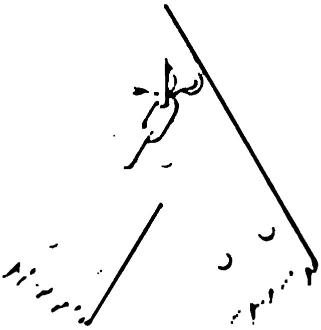


Fig 13



3. The length of the line, calculated according to the stage of the water at mean tide, may easily be added to or taken from.

4. The raft, being composed of a number of small parts, is flexible, and moves with the waves without losing in strength.

5. The obstruction is speedily placed, and, after the necessity for obstructing the channel has passed, may be as speedily removed, and the frames, chains, and anchors may be stored away without danger of being destroyed by rot, &c.

6. The cost-price is less than that of ordinary raft-obstructions properly built and properly anchored.

(*b*.) *The Rope-obstruction* (see figs. 8 and 18) is formed as already previously described. Instead of using solid floats, like those used at Charleston and Mobile (see fig. 6), it is, however, proposed to attach the main hawser to buoys containing a cast-iron by contact igniting torpedo, which, being drawn with the rope and hawser into the wheel or screw of a vessel, would injure her very considerably by its explosion.

The most desirable model of an anchor for rope, as for all floating obstructions, appears the one indicated by fig. 19.

(*c*.) *Torpedoes* will be fully described in the following chapters. Those indicated in Plate VI*., fig. 18, are partly by contact self-igniting torpedoes, and partly electric torpedoes, to be fired at will. The latter class will always be used whenever it is necessary to leave an opening in the line of obstructions for vessels to pass in or out.

The width of this gap must vary with the locality, and also depend on the views of the naval officer commanding the station: 450 feet, however, would appear its very minimum.

It is self-evident that the placing of rope-obstructions and of by contact self-igniting torpedoes across that part of the channel over which vessels of the national fleet may have to pass—that is, in front of the opening in the obstruction—is inadmissible.

In the case of urgent emergency, rope-obstructions and friction-torpedoes may be placed in time to prepare for an attack.

In connection with this subject, it appears proper to call attention to the importance of taking advantage of time of peace to drill engineer-troops in the placing and removing of floating obstructions. Pontoniers are now practised in throwing bridges of all kinds across water-courses, why not extend their drill to obstructions also?

5. *Captain Piron's System.*

Captain F. P. J. Piron, of the French Corps of Engineers, endeavours to expose the theoretical defects of all the systems described in this and the preceding chapter by basing his very interesting mathematical calculations on formulæ which are derived from certain laws and observations in natural science.

The strength of obstructions formed by piles, and the efficiency of rope-obstructions and of rafts, however, have been so clearly established by actual experience during the American war, that we may trust implicitly to them for stopping vessels, even such as the *Achilles*, *La Gloire*, *Dunderberg*, and their like; and especially if they are enfiladed by batteries of the same calibre as that of the *Monandnok*, which, though mounting only two guns, would, according to Admiral David D. Porter's opinion, be more than a match for the *Dunderberg*, in spite of her battery of 18 guns.

Admiral Dupont's iron-clads were obliged to withdraw from their attack on Fort Sumter (see Chapter VII.) after an engagement of hardly forty minutes' duration; yet every one of these Monitors had a turret the plating of which was much thicker than the casemate-armour of the *Dunderberg* (this is only 4·5"), and no heavier piece of ordnance than the 10-inch columbiad was at that period used in the Confederate States' service. The rope-obstructions which had been placed between Forts Sumter and Moultrie proved themselves of the greatest value on that day (April 7th, 1863); and even had vessels of the class above mentioned made a serious attempt to pass these

RP SYSTEM.

ig 20

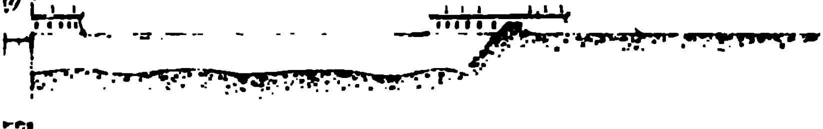
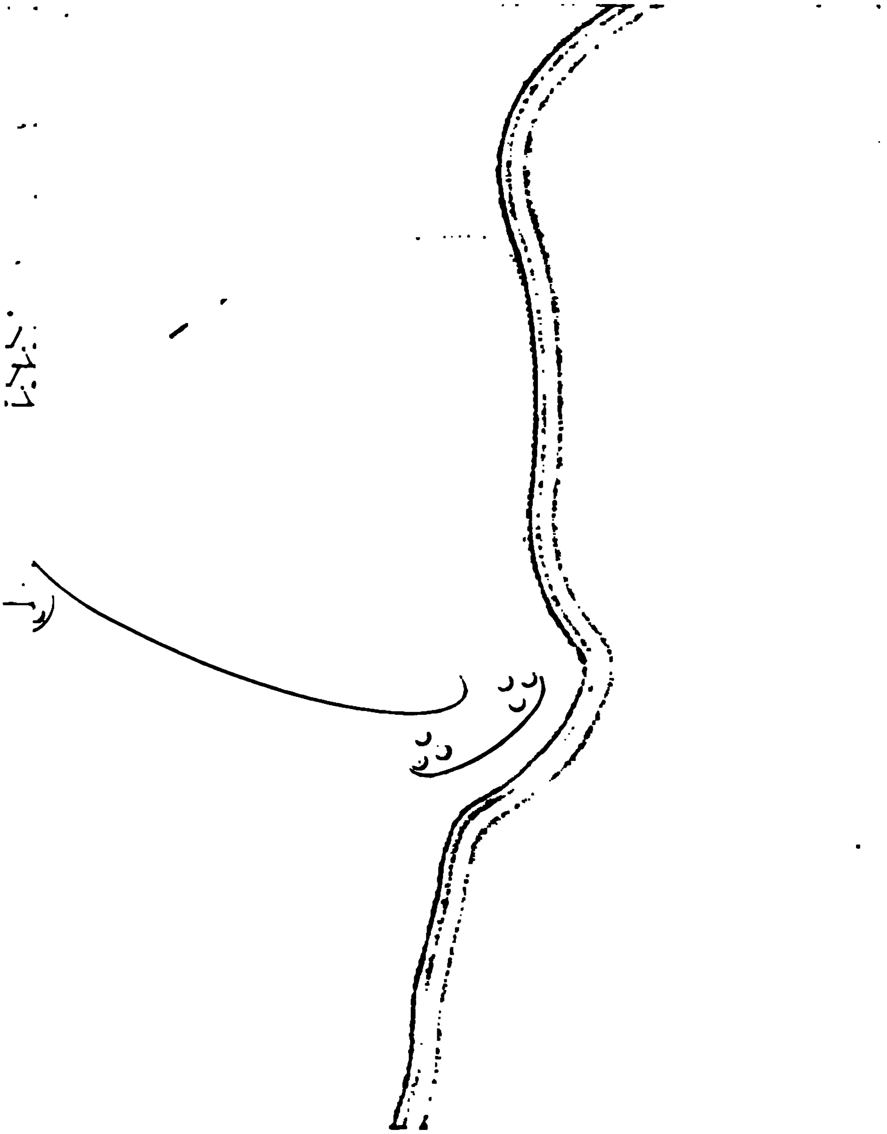


Fig 21



obstructions, they would most certainly have fouled them. If the effect of the concentrated fire from Forts Sumter and Moultrie and the shore-batteries was such as to compel the heavily plated Monitors to break off the engagement, what would it have been on the *Dunderberg*, *La Gloire*, *Achilles*, and their like? A stanch wooden ship, in which the sailor "takes what comes" (Admiral Porter's words), has, under such circumstances, a better chance for success than any of these large, badly protected iron ships, which are by no means the most dangerous in an attack on obstructions and properly constructed shore-batteries.

Captain Piron furthermore takes the ground that a vessel running on or against a floating obstruction should not be able either to move or to submerge the same. With more justice, perhaps, he asserts that the meaning of the adage "*qui veut la fin doit vouloir les moyens*" should be fully carried out in the case of all obstructions intended to bar the approaches to an important sea-port. Captain Piron's plan may be understood from the following, which is an extract (in translation) from his '*Essai sur la Défense des Eaux*.'

ON THE APPLICATION OF A SYSTEM OF FLOATING IRON OBSTRUCTIONS TO THE DEFENCE OF SEA-PORTS, ROADSTEADS, AND RIVERS.

General Description.

The obstruction is formed by huge sheet and wrought-iron buoys, long and flattened in form, and whose principal dimensions are as follows:—

Length	300·00	mètres
Width	75·00	„
Height	7·50	„
Diameter of elliptical torus	1·50	„
Thickness of sides of torus	0·025	„
Thickness of horizontal partition supported on the reenforce	0·025	„

Thickness of iron sheets used for the hull	0·012	mètres
Thickness of longitudinal bulkheads	0·010	,,
Thickness of transverse bulkheads	0·009	,,
Diameter of rivet-bolts from	0·020, 0·025 to 0·030	,,
Mean draught of water	1·42	,,
Total weight of iron	25,000	tons

Three openings are made—one at the centre, and the other two at the foci of the ellipse of construction, through which the anchor-cables are intended to pass.

By establishing communication between the compartments into which the hull is divided, and by providing them with suitable means for ventilation, they may, in time of peace, be used as workshops, manufactories, store-houses, &c.; all openings made through the partition walls and the deck would have to be closed in time of war.

This structure might in all cases be provided with propellers whose engines would subserve purposes of industry during peace.

Its large surface renders it suitable for being used as a wharf, whilst its light draught of water would enable it to carry a very heavy load.

Besides, by freighting it with ballast its weight might be increased to 30,000 tons, making its mass three times that of the largest iron-plated frigate.

Resistance to Immersion.

One of the principal features of this obstruction is, that it cannot be submerged. Being divided into compartments, which are formed by water-tight partitions, it will remain afloat, even after a furious bombardment; in fact, the enemy will not be able to destroy more than one-half of the 18,000 compartments which form the frame of the structure, leaving the other one-half uninjured and of sufficient buoyancy to prevent the hull from sinking.

As to its being sunk by an iron-clad vessel, the thing is impossible; if by the shock of the vessel a crack in the reenforce should have been opened, the partitions would prevent the water from flooding the hull; and if the ship were provided with an inclined prow, it could not mount the obstruction, because the latter, having greater mass, would remain afloat, while the vessel, in order to rise, would perform a quantity of work great enough to destroy its *vis viva*.

A frigate, drawing at least 6 mètres, and the obstruction standing about 4 mètres above water, it follows that the vessel, in order to mount the obstruction, must rise 10 mètres.

Suppose the weight of the vessel to be 10,000,000 of kilogrammes, then, if it slide a distance of 50 mètres over the surface of the obstruction (the friction of iron on iron being one-fourth of the pressure[*]), it will expend

$$\text{a force} = 10{,}000{,}000 \times 10 + 2{,}500{,}000 \times 50 = 225{,}000{,}000\ k.m.$$

while the maximum *vis viva* of an iron-clad is only 50,000,000. It is impossible, then, that such an obstruction could be passed by even the *Great Eastern*.

Resistance to the Shock of a Vessel.

According to our supposition, the most powerful shock of the largest iron-plated frigate represents a quantity of work equal to 50,000,000 kilogrammètres.

We know that to destroy the *vis viva* acquired by the vessel, it is necessary to utilize the quantity of work performed by the resistance of the material constituting the obstruction.

In the system which we are examining, though resistance to flexion has been provided in the construction, it is yet quite certain that it is the resistance to *shearing* which will tend to destroy the *vis viva* of the vessel.

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[*] Captain Piron seems to overlook the fact that the bottom of an iron-clad is not covered with iron; it is either the naked wood, as in the case of the *Tennessee*, *Richmond*, &c., or copper-fastened.

In fact, the resistance which the obstruction offers to flexion and its great mass will enable it to support the shock without moving till its inertia is overcome.

Calling the velocity with which the vessel is moving before the shock = V;
The velocity after the shock = U;
The mass of the vessel = M;
The mass of the obstruction = M′;
we will have

$$U = \frac{M}{M + M'} V$$

Substituting the weight P and P′ for the mass M and M′, and multiplying the nominator and denominator of the above fraction by g (= specific gravity), we find

$$U = \frac{P}{P + P'} V$$

By making

$$P = 10{,}000 \text{ tons,}$$
$$P' = 25{,}000 \text{ tons,}$$
$$V = 10 \text{ mètres,}$$

we find the value of

$$U = \frac{10{,}000}{10{,}000 + 25{,}000} \times 10$$

$$U = 2{\cdot}86 \text{ mètres.}$$

Thus, after the shock the obstruction and vessel will move with a velocity of 2·86 mètres.

In calculating the loss of force caused by the shock, we find that it corresponds to a quantity of work:

$$\tfrac{1}{2} \times \frac{M'}{M + M'} M V^2 = 36{,}000{,}000 \ k.\ m., \text{ about.}$$

How has this quantity of work been consumed? Evidently by the resistance of the material displaced by the shock.

Supposing the vessel to have received no injury, and its sharp prow to have cut into the reenforce, and an adjacent part of the hull, the iron of the obstruction will have been penetrated to a depth that may be determined by formulas according to which resistance to shearing is calculated.

The resistance T offered by the reenforce to shearing is

$$T = \frac{C\,\pi\,(R^2 - r^2)}{2} = \frac{40{,}000{,}000 \times 3{\cdot}14\;(0{\cdot}750^2 - 0{\cdot}725^2)}{2}$$

$$T = 2{,}577{,}800 \text{ kilogrammètres.}$$

This force deducted from the above given loss of force leaves still 3,422,200 kilogrammètres to be accounted for.

We have now to consider the force which is required for the cutting through the sides of the hull and of the medial horizontal bulkhead, giving for the three sheets a thickness of 0·045 mètres. From this force the maximum depth to which the sharp prow of the vessel may reach after having penetrated the elliptical torus may be derived.

C = force necessary to cut through a section of one mètre square;

a = base of a rectangular section;

b = height of the rectangular section in the direction of the force applied;

P = force required to cut through the section $a\,b$.

$$T = \frac{C'\,a\,b^2}{2}$$

$$b = \sqrt{\frac{2\,T}{C'\,a}} = \sqrt{\frac{2 \times 33{,}422{,}200}{40{,}000{,}000 \times 0{\cdot}045}} = 6{\cdot}10 \text{ mètres.}$$

By this last value of b we obtain the maximum depth to which the sharp prow of the vessel will penetrate in shearing the walls of the hull after the elliptical torus has been cut through. To this value must be added the diameter of the reenforce, making the total depth of penetration into the obstruction 7·60 mètres.

In fact, this depth would be even less, for we have not taken into consideration the resistance offered by the sides of the compartments which the prow of the vessel would necessarily have to encounter. The prow being cuneiform, it will have the tendency to crush the compartments which will resist by opposing the penetration of the wedge.

In making the estimate of the resistance offered by the obstruction we did not speak of the damage which the vessel must inevitably sustain by striking against a mass offering so great a resistance as the floating iron-obstruction.

The ship will receive injuries that will destroy a part of its *vis viva*, and the velocity, U, after the shock will very probably be less than 2·86 metres.

Figs. 20 and 21 of Plate VI^a. will serve to illustrate Captain Piron's idea.

The channel which is obstructed has a width of 600 mètres; two buoys are, therefore, sufficient in this case. They are, during time of peace, anchored along the banks or shores, in which indentations are made for this purpose.

Three turrets serve as abutments to the buoys, the two turrets near the shores receive each six iron cupolas, the turret in the middle of the channel receives three cupolas. These cupolas are armed with pieces of heavy calibre.

During war, the obstruction may serve as a bridge connecting the opposite banks or shores.

Captain Piron estimates the cost of the two buoys and his three (unnecessarily large) iron turrets at 15,000,000 francs.

B.—TORPEDOES.

CHAPTER XII.

(a.) Experience demands Simplicity of Construction.—(b.) Torpedoes are divided into.—(c.) Methods of Firing Torpedoes.

TORPEDOES occupy the same place in naval warfare as mines in land operations.

(*a.*) Of simple construction, and requiring heavy charges in but exceptional cases, they are readily placed, and possess over mines the peculiar excellence, that by their explosion no funnel is created in which, as is often the case with the mine, the enemy may effect a lodgment. On the contrary, the first object of the torpedo—that of sinking a vessel which is attempting to force a passage—is not only obtained whenever the explosion takes place at the right moment, but every vessel sunk is an additional obstacle placed in the way of the enemy's fleet.

Although torpedoes may have been known previous to the American war, their use on a large scale and with marked success dates from that period only.

The newly created navy of the Southern Confederacy was not sufficiently strong in a naval engagement to cope with the powerful fleets of the United States, nor to guard the many inlets by which the interior of the country may be reached, against an invasion by ships superior in number, in build, and in armament. Neither had old established or newly built fortifications proved themselves adequate to keeping out the enemy's ships whenever they made a serious attempt at passing. The importance of obstructions and torpedoes was, therefore, recognised at a comparatively early stage of the war.

Animated by an earnest desire to render their country some service, or perhaps attracted by the thought of the premium offered by the Confederate States' Government for the capture or destruction of any vessel of the enemy, many an ingenious mind turned its attention to the task of inventing some *machine infernale* by which the largest and most powerful vessels—the *Great Eastern* herself—might inevitably be sunk within a few moments after having been struck.

It is not intended here to give a history of the development of the torpedo. Suffice it to say, that the War Department and the chief engineers of the several departments were worse than importuned by the applications of inventors, every one of whom demanded an examination of his plan or model. Such requests having to be granted for fear of possibly overlooking a perhaps really useful invention, the attention of examining committees would, naturally enough, often be called to the most absurd schemes. There were torpedo twin boats, propelled by rockets; diving apparatus by means of which torpedoes might be attached to the bottom of the enemy's ship; balloons that were to ascend, and, when arrived just above the vessel, were to drop some kind of torpedo on the deck of the ship; rotation torpedo-rockets to be fired under water; submarine boats, with torpedoes attached to their spar; in fine, any variety of plans, and yet but few, very few practicable ones.

The great error which most of these inventors fell into was, that they aimed at accomplishing, all at once, too much in a field which to all of them was still an unexplored *terra incognita.* Complicatedness of the apparatus was the next consequence, out of which resulted its utter failure on being tried. Certain it is that those torpedoes by which the heaviest losses were caused to the Federal fleet during the American war excelled in simplicity of construction and in cheapness.

(*b.*) Torpedoes may be (first) stationary: fastened to piles, to rafts, or to any other obstruction; anchored to weights that keep them floating at a certain depth in their position; used on land, for instance, on the foot of the glacis of fortifications, as a means by which to render a breach impracticable to an assaulting column, to strengthen an exposed position, &c.; or (secondly) they may be used in offensive warfare: floating on the water, and driving with the current and wind; propelled by machinery; or attached to the prow of an iron-clad, or to the spar of a torpedo-boat.

Torpedoes may also be classed into—

α. Torpedoes which are by contact self-exploding.

β. Torpedoes the firing of which rests in the hands of the operator on shore or on board a vessel.

(*c.*) The methods of firing torpedoes can hardly involve any new fundamental principles, yet success or failure depends on the more or less practical way in which these principles have been applied. During the American war, the following methods were used:—

1. Firing by the match.
2. ,, acids (concussion and clock-work).
3. ,, percussion.
4. ,, friction.
5. ,, electricity.

We shall endeavour in the following three chapters to set forth the advantages, as well as expose the defects, of these several methods used.

CHAPTER XIII.

Torpedoes fired by—(a.) the Match; (b.) Acids; (c.) Percussion.

THE degree of perfection reached by the technics of the present day will exclude the application of the match as a means of effecting the ignition of the charge, whenever any other method of firing the torpedo is possible.

(*a.*) The quick-match can be used with stationary torpedoes alone, and then only when the distance between the shore and the torpedo is a short one. Like all other not by contact self-exploding torpedoes, the torpedo which is to be fired by the match will require a station of observation on shore; this station will, in this case, always be in the immediate vicinity of the enemy's vessels, and within the range of his musketry. It is therefore evident that the party whose duty it is to watch the progress of the enemy, and to fire the torpedo at the right moment, will be much exposed. But granting even that reliable persons may be found for the faithful performance of this dangerous service, the method itself still presents too many technical and theoretical imperfections for us to regard it otherwise than as a mere make-shift. For this reason we omit also any further description of the apparatus, which for the rest is extremely simple.

A contrivance of a not less primitive character was the *demijohn-torpedo*, which, if we are not mistaken, was at first used on the Yazoo River. (See Loss of Iron-clad *Cairo*, Chapter XVII.)

The demijohns were filled with powder, and were kept floating a few feet below the surface by means of buoys to which they were attached. The buoys themselves were by ropes anchored to weights of some kind. The ignition of the charge was effected by a friction tube, from the ring of which a long string led to the station on shore.

General attention, however, having been attracted by the loss of the *Cairo*, greater stress was now laid on the perfection and the construction of torpedoes. The next step was to devise a plan which rendered a station of observation unnecessary on shore; or, in other words, to construct a torpedo which should be fired by the mere contact with the vessel.

Hence resulted next:

(*b*.) *The torpedo fired by acids.* (See Plate VII.)

Fig. 1 represents the section of a cast-iron torpedo, which by the flanges (*g g*) (of which the torpedo had four) was attached to a strong framework. (See fig. 9, Plate IX.) A vial (*c*) filled with potassium, and a vial (*d*) filled with sulphuric acid, were placed (well packed in cotton) in the lead tube (*b b b b*). The tube was about six inches long, and consisted of two parts; the upper one (the one exposed to the action of the water) was made of one piece of lead without seam, whilst the lower one, which contained the composition (*e e e e*), had its sides and bottom perforated. The two parts having been fastened together, were placed into the brass cylinder (*a a*), which was screwed into the fuze-hole of the torpedo (*f f*). Water was excluded by coating the tube (*b*) and cylinder (*a*) with a cement impervious to water. A vessel striking the tube (*b b b*) would bend it; the vials (*c* and *d*) were broken; the sulphuric acid mixed with the potassium, causing the ignition of the composition (*e e e e*), and through it the explosion of the charge (*h*). The explosion-apparatus is simple and reliable; by giving the torpedo three points of explosion the certainty of effect may be secured.

When attached to piles or to frames they are eminently practical. In this way they were chiefly used near Charleston, but also in the Ogeechee and Savannah Rivers. The Monitor *Montauk* is believed to have been struck by one of these frame-torpedoes during the attack on Fort McAllister, March 3rd, 1863.

The frames consisted of three or four heavy timbers, parallel to each other, and a few feet apart, tied together by cross-timbers; to the head of each timber the above described, or a friction-torpedo was attached. The frame was placed obliquely, and held by weights, so as to present its torpedoes to the bottom of a vessel approaching.

Under No. 5, Chapter XVII., the explosion of one of these torpedoes under the United States' steamer *Jonquil* is mentioned. A somewhat more complicated form of the torpedo to be fired by acids is represented by fig. 2 of Plate VII.

(*a*) is the pile shown in several of the figures of Plate V.

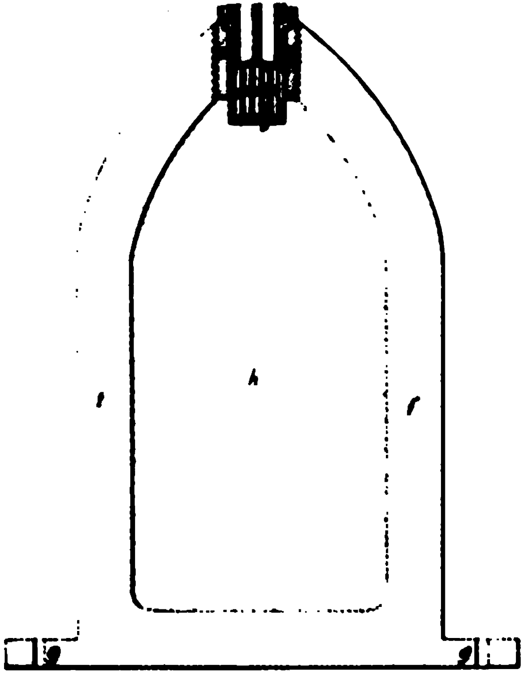
(*b b b*) is a cast-iron hollow cylinder, firmly secured to the pile (*a*). In it slides the cast-iron torpedo (*c c*), into which reaches the rod (*d*). The bottom (*f f*) of the torpedo rests on the spring (*e e*). (*g*) is an easily ignited composition; on it rests the vial (*h*), containing potassium, separated by a thin perforated plate of copper from the vial (*i*), filled with sulphuric acid, on which rests the charge (*k*).

A vessel striking the torpedo forces it down on the rod (*d*), which passes through (*g*, *h*, and *i*), breaking the vials, thereby causing an ignition in the above-described manner. The construction of this torpedo is based on the same principle which has been followed in the construction of the Belgian fuze. It is, however, so complicated that it will hardly be used for the future.

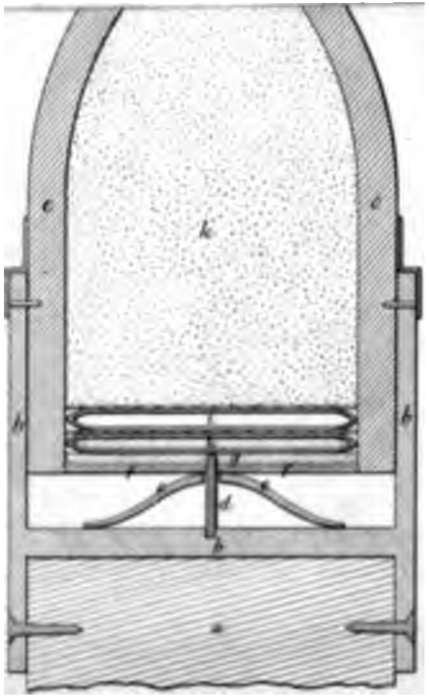
Near Charleston, a number of these torpedoes have been employed. No damage has resulted from them to the Federal fleet. An even more complicated system of firing this class of torpedoes presents the application of clock-work.

Floating torpedoes, left to the action of wind and current, were sometimes provided with a clock-work, whose hammer would break the two vials in a given time. It is certain that these torpedoes would explode after having floated in the

Plate VII.



FRAME TORPEDO



PILE TORPEDO.

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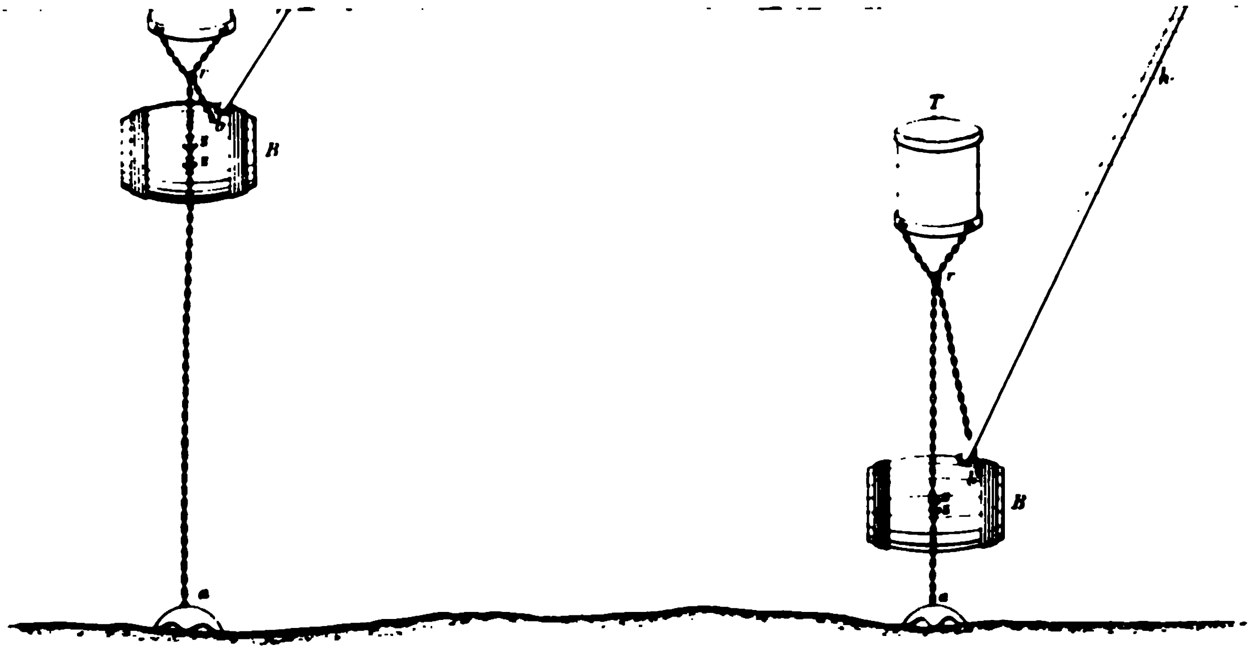

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water two, three, four, and more hours, according to the regulation of the clock-work; but whether the transports *Maple Leaf* (see No. 9, Chapter XVII.), *Harriet Weed*, and another (name unknown) have, on the St. John's, been sunk by torpedoes provided with clock-work and acids, or by torpedoes of a different construction, we have not been able with certainty to ascertain. We are, however, led to presume that complicated contrivances of this class are very harmless. (See Chap. XIX.)

(*c.*) *Torpedoes fired by percussion.* (Plate VIII.)

Previous to General Raines having invented his friction-torpedo, a torpedo constructed by Mr. E. C. Singer was much used in James River, in Charleston Harbour, and in the Bay of Mobile.

This torpedo, like all others that require the application of springs, was somewhat complicated; however, not enough so to prevent some engineer officers of note to make the following report:

REPORT OF A COMMISSION ON SINGER'S TORPEDO.

"ENGINEERING HEAD-QUARTERS' DEPARTMENT,
"Northern Virginia, July 14th, 1863.

"COLONEL, In accordance with your order of the 13th, appointing the undersigned a commission to examine and report upon the merits of Mr. E. C. Singer's torpedo, we beg to state that we have carefully examined the same, and submit the following report:

"*First.* 'As to the plan for exploding the charge.' In this plan or lock, in our opinion, consists the great merit of the invention. The lock is simple, strong, and not liable at any time to be out of order; and as the caps which ignite the charge are placed within the powder-magazine, they are not likely to be affected by moisture; while the percussion is upon the exterior of the magazine, actual contact with the rod which acts as a trigger is necessary, but by mechanical contrivances the contact may be obtained in various ways.

"*Second.* 'The certainty of action' depends, of course, upon contact, but by the peculiar and excellent arrangement of the lock and plan of percussion mentioned above, the certainty of explosion is almost absolute. One great advantage this torpedo possesses over many others is, that its explosion does not depend upon the action or judgment of an individual, that it is safe from premature ignition, and at the same time is cheap and portable, while its position in river or harbour cannot readily be ascertained by an enemy's vessel.

"*Third.* 'The efficiency of its explosion, if made in deep channels,' cannot well be ascertained without experiment, but would be the same as submarines fired by any other contrivance. We are of the opinion, however, from the best information accessible, that if the powder—say one hundred pounds in quantity—is within the distance of fifteen feet from the keel of the vessel when exploded, its efficient action is not materially affected by the depth of the channel. Of course the quantity of powder required would have to be determined by experiment. Rifle-powder, from its rapid combustion, would be preferable in deep water to cannon-powder, while some of the detonating compounds would doubtless effect certain destruction to vessels passing over torpedoes at even greater depth.

"The peculiar arrangements for firing the batteries would have to be determined by the circumstances of position and draught of vessels and motion of currents, depth and width of channels, and would require the exercise of great judgment on the part of those intrusted with the duty of placing them.

"We are so well satisfied with the merits of Mr. Singer's torpedo, that we recommend the Engineer Department to give it a thorough test, and, if practicable, to have some of them placed at an early day in some of the river approaches of Richmond.

"*General Remarks.*—The mode of loading the torpedo dispenses with any connexion through the case of the magazine, involving no packing of any kind.

"The risk of the lock fouling by sand or mud, if on the bottom of a stream, we think can be prevented by enclosing it in a metal case, which would be nearly water-tight. In narrow streams, these could be placed in 'quincunx,' so that a vessel attempting to pass would be sure to come in contact with some one.

"The inventor also claims to be able to go to a vessel with one or two, and get them in contact so as to explode. This can be done, but so much depends on the nerve and daring of individuals that there is no certainty of it. Judging from the success of blasting rocks by powder, superposed upon the rock with a deep column of water over it, we are of the opinion that the depth of water below a torpedo would not interfere with its success. Lieutenant Bolton, who saw and blasted a great deal in East River, near New York, says one hundred pounds of powder, fifteen feet from the bottom of a vessel, would break her sides or bottom.*

"We would add, that a proposed adaptation of these locks to the explosion of shell or batteries under railroad tracks, for defences of approach to fortified works, and for blowing up bridges, seems to us very simple and effective, also an ingenious plan for affixing torpedoes to spar or bow of an iron-clad.

"We consider the employment of submarines as a legitimate mode of defence, and, as officers connected with the defence of Richmond, feel it our duty to recommend torpedoes as a powerful accessory to our limited means. The moral effect of an explosion upon an enemy would be incalculable, and would doubtless deter them from attempting to bring troops by transports to points accessible to the city as White House or Brandon.

"Respectfully submitted,

"W. H. STEVENS, "Colonel, Engineers.
"JOHN A. WILLIAMS, Major, Engineers.
"W. G. TURPIN, Captain, Engineers.

"*To* COLONEL J. T. GILMER, Chief Engineer."

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* The fallacy of this opinion has long since been proved by experience.

DESCRIPTION. (Fig. 1, Plate VIII.)

To the torpedo, which is constructed of light boiler-iron, is secured the bed-plate (*a a*). The bed-plate has three uprights (*o o o*), one of them (*o'*) is on the end of bed-plate (*a*), which enters the magazine; it has a set screw (*g*). (*f*) is a rod, on each end of which are placed caps (*m* and *m'*), one resting against the top of the torpedo, and the other against the end of the set-screw (*g*). This screw adjusts the rod (*f*), and keeps it in position. The bolt (*b*) slides in the uprights (*o o*); it has a strong spiral spring (*c*) running lengthwise and working towards upright (*o'*). In the forward end of bolt (*b*) is an opening through which passes the end of rod (*n*) attached to the trigger (*e*). On the upper end of the upright (*o*) is a disk (*d'*), on which is placed a corresponding disk, which forms a part of trigger-rod (*e*).

In the end of bolt (*b*), in advance of the centre-upright, are placed two holes (*j* and *h*), through which are passed the loop (*j'*) and the safety-wire (*h'*); the latter prevents the end of the bolt (*b*) from coming in contact with the top of the torpedo over the cap (*m*).

A pressure from any direction against the trigger (*e*) causes the disk (*d'*) to assume the position shown in fig. 2; the pin (*n*), which is the continuation of the trigger, is drawn out of its opening in bolt (*b*), and the bolt is released. Instead of two caps (*m* and *m'*), four may be used, in which case the rods (*b* and *f*) must be divided near their ends.

The torpedo is by a chain fastened to its anchor. When it has reached its fixed position, the safety-wire (*h*) is withdrawn; the string (*i*) is, for this purpose, with one end tied to the loop of the wire (*h*), the other end remains in the boat. from where, when at a distance of 50 feet from the torpedo, the safety-wire is withdrawn.

The trigger-rod (*e*) is in a vertical position just below the surface of the water; it is forked in three prongs to ensure a

Plate VIII.

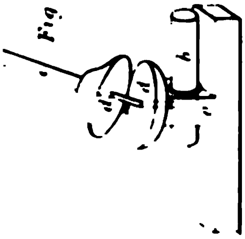

Fig 2

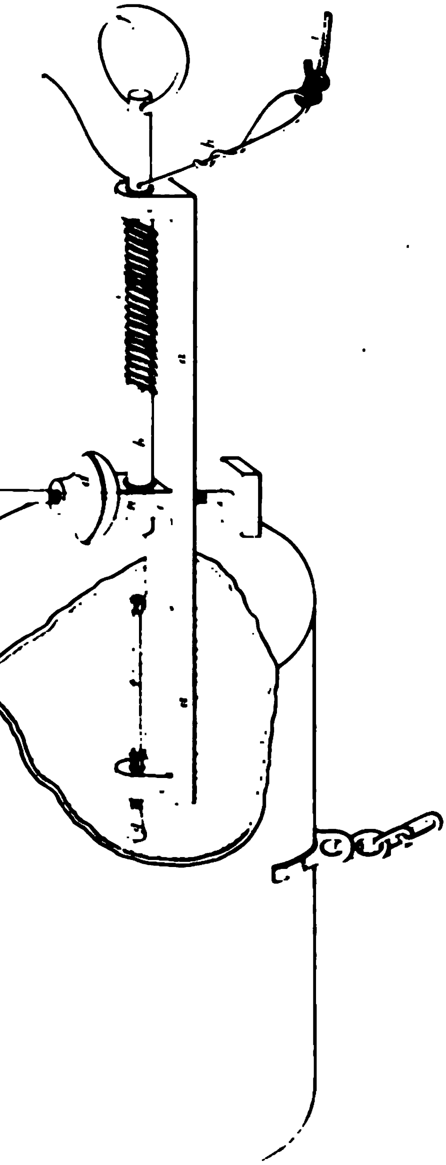

Fig 1

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sufficient number of contact points. Any part of a vessel coming in contact with the trigger causes it to assume the position shown in fig. 2, releasing the bolt (*b*), which by the spiral spring (*c*) causes the caps and the charge to explode.

Without being very complicated, Mr. Singer's torpedo did not lead to the anticipated results after it had remained for six or seven months in fresh water, or had been lying for even one month only in salt water. In the first case, the spring (*c*) seemed to have lost its force, and did not drive the bolt (*b*) with sufficient power to cause the explosion of the caps.

In the latter case, the marine worms had attached themselves to the torpedo and the end of the bolt (*b*), deadening the force of the blow on the caps, and thus preventing the explosion of the charge. This was especially observed during Admiral Farragut's attack on Fort Powell, in February, 1864. A number of these torpedoes had been placed in Grant's Pass, and even west of it; the mortar-schooners of the Federal fleet very often crossed the zone of the torpedoes without causing a single explosion. On examination, it was found that the marine worms (*teredo navalis*, *limnaria*, and others which are very destructive in those waters) had formed perfect clusters on the top of the torpedo between the caps and the bolt (*b*); the pin (*a*) had been withdrawn from the bolt by, as it appeared, a vessel having come in contact with the trigger-rod (*e*); the spiral spring (*c*) had played, but the force of the blow had been deadened by the shells, and explosion was thereby rendered almost impossible.

A tin or sheet-iron casing placed around the lock would protect it against the marine worms. It would not be well, however, to advocate any system that requires the application of springs. When remaining in a compressed position for a long time, they must of necessity lose more or less of their strength, and the explosion is consequently rendered less certain. Another objection to all systems of firing torpedoes by percussion is, that they are more complicated, and more costly than either the torpedo mentioned under (*b*) in this chapter, or the one described in the following chapter. We object also to the trigger-rod reaching so near the surface; the least current, in breaking itself against the trigger-prongs, will produce ripples on the surface, which, to a vigilant enemy, will always be a certain indication of danger. A third objection is found in the ease with which the enemy may explode these torpedoes, by means of drag-ropes or torpedo-nets; the long trigger-rod with its prongs being necessarily readily caught by either the rope or the net.

Mr. Singer's torpedo of later construction contained an air-chamber. The charge consisted of from 50 lbs. to 100 lbs. of cannon-powder.

For "effect of torpedoes" we refer to Chapter XVII.

CHAPTER XIV.

Torpedoes fired by Friction.

To Brigadier-General Raines, then in charge of the laboratory at Augusta, Georgia, is due the credit of first having applied a method of igniting torpedo charges, that in simplicity and in certainty of effecting the explosion will favourably compare with any other method.

The fuze explodes whenever it comes in contact with the vessel passing near or alongside of the torpedo.

Fig. 6, Plate IX., shows a section of General Raines' sensitive fuze, one-third of the size of the one used by the General himself.

The fuze-head (d') contains a composition of—

Chlorate of potassa	50%	of the volumen,
Sulphuret of antimony ..	30%	
Pulverized glass	20%	

which renders the fuze very sensitive.

A rapidly burning composition (gunpowder that had been dissolved in alcohol) communicates the fire to the powder in the tube of the fuze, and through it to the charge of the torpedo.

This fuze is so sensitive that a light blow with a small hammer, a stick of wood, &c., is sufficient to explode it.

General Raines was also the first to use oak-barrels for the body of torpedoes.

The barrel is made impervious to water by being pitched inside, and receiving a coating of tar on the outside.

Two cones made of very light wood (see section of the improved Mobile Bay torpedo, fig. 7, Plate IX.) (cc) are attached to the ends of the barrel by means of iron hoops and screws or nails.

The object of these cones is a threefold one:—

1. They protect the bottom and top of the barrel (*b b*) against being driven in by the shock of a vessel striking them, especially if there is a space (*h h*) left between the cone and the bottom or top of the barrel, whereby the shock of the vessel is at once transplanted on the staves.

2. The torpedo receives a form, which, being pointed, offers but little resistance to the current. It is thus an advantage the importance of which will be understood when we consider that the less resistance a torpedo offers to the current, the less will its presence be indicated on the surface of the water, and the less weight is required for the anchor to be by which the torpedo is held in position.

3. Great buoyancy is given to the torpedo.

Having thus indicated the general principles according to which the sensitive-fuze barrel torpedo is constructed, we shall now consider the several manners in which the fuze was introduced in the barrel.

(*a*.) Fig. 4, Plate IX., is a section of the apparatus as it was chiefly used in Charleston Harbour and vicinity.

The drawing is made two-ninths of full size.

(*b b*) is a square cast-iron or brass flange suited to the curvature of the outside of the keg, and carrying the collar (*b b*). This flange is fastened to the wooden staves (*a a*) by screws, as represented. The collar (*b b*) is tapped ten threads to the inch to receive a hollow brass plug (*c c c c*), into which is slipped the plunger (*f f*), having a projection at its base, and confined in the bore of the plug to prevent its falling through. Screwed in the lower end of the plug is the nipple (*d d*). Through the nipple is inserted the sensitive fuze (*g′g*) containing the explosive material. Water is excluded from around the plunger by the stuffing-box nut (*e e*), and the indian-rubber packing (*i i i i*).

The small hole (*k*) in the plunger is intended for the inserwater two, three, four, and more hours, according to the regulation of the clock-work; but whether the transports *Maple Leaf* (see No. 9, Chapter XVII.), *Harriet Weed*, and another (name unknown) have, on the St. John's, been sunk by torpedoes provided with clock-work and acids, or by torpedoes of a different construction, we have not been able with certainty to ascertain. We are, however, led to presume that complicated contrivances of this class are very harmless. (See Chap. XIX.)

(*c*.) *Torpedoes fired by percussion.* (Plate VIII.)

Previous to General Raines having invented his friction-torpedo, a torpedo constructed by Mr. E. C. Singer was much used in James River, in Charleston Harbour, and in the Bay of Mobile.

This torpedo, like all others that require the application of springs, was somewhat complicated; however, not enough so to prevent some engineer officers of note to make the following report:

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(*a a*) is the stave of the barrel, 1 inch thick. (*b′ b′*) is a square cast-iron or, better, brass flange, suited to the curvature of the outside of the barrel, and let into the staves, to which it is fastened by screws, or, if preferred, by copper bolts and nuts. It carries the collar (*b b*), which is tapped ten threads to the inch. In it is screwed the brass plug (*c c*), in which is inserted the sensitive fuze (*d d′*).

The copper-plate (*e*) and the safety-guard (*f*) are the same as above described.

Fig. 7 is a section through the torpedo, one-ninth of full size.

The torpedo is supposed to have been placed in position, and the safety-guard (*f*) is, therefore, taken off. (*b b*) (*c c*) (*h h*) have already been described above. (*d d*) is the charge (about 50 lbs.) surrounding the air-chamber, which is formed by the tin or zinc cylinder (*g g*) resting on the top and bottom of the barrel (*b b*).

For the weight (*f* in fig. 2) the handle (*e*) has been substituted, by the weight of which the five points of explosion (see fig. 8) are intended to be kept pointing upwards.

In this handle (*e*) turns the swivel (*f*), to which is secured the chain, by which the torpedo is fastened to its anchor.

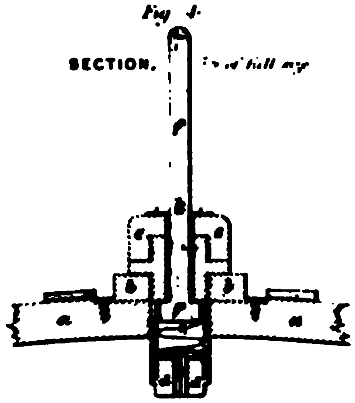
The hoops which hold the staves (*a a*) of the barrel together are made of wrought-iron, and are 1 inch wide and 0·25 inch thick.

The object of the air-chamber is to give the torpedo great buoyancy, thus enabling it somewhat to resist the shock of the vessel, by which resistance, feeble as it is, the friction of the bottom or sides of the vessel against one or more points of explosion is rendered so great, that an explosion is certain to follow.

Under "effect of torpedoes" (Chapter XVII.) will be proved that large charges are necessary only in certain cases (for instance, when the torpedo has to be placed at so great a depth that several feet of water will probably remain between it and the vessel passing over it), and as experience has estab-

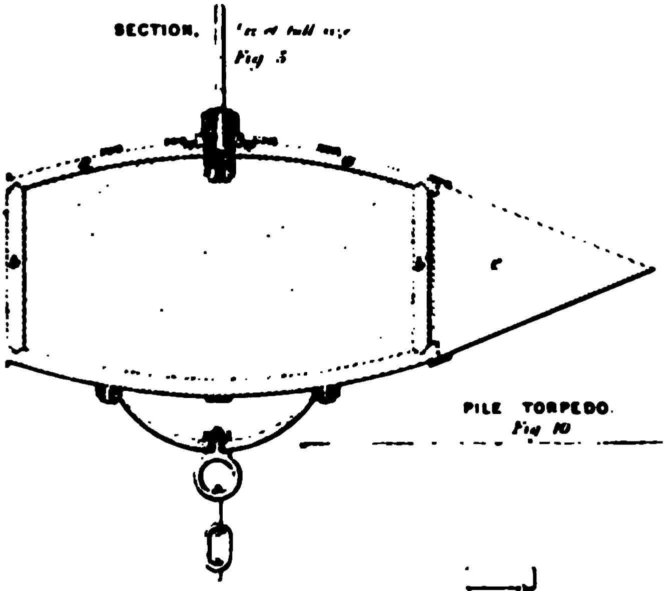
Fig 4.

SECTION. ½ of full size



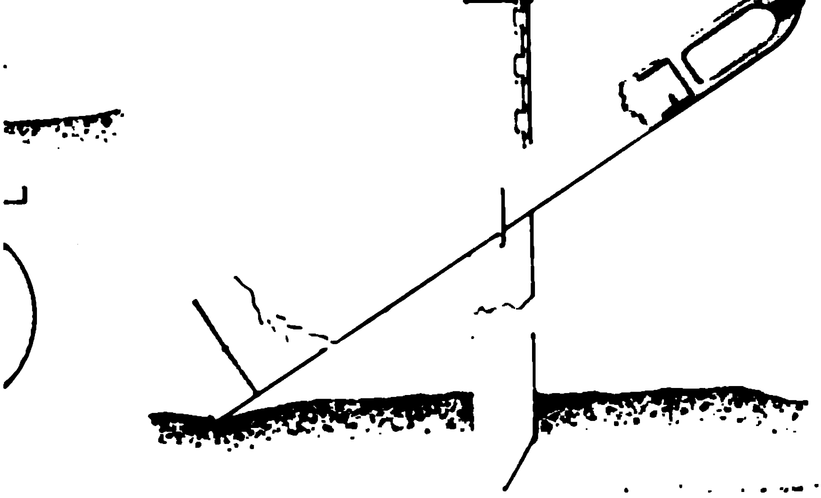
SECTION. ½ of full size

Fig 5.

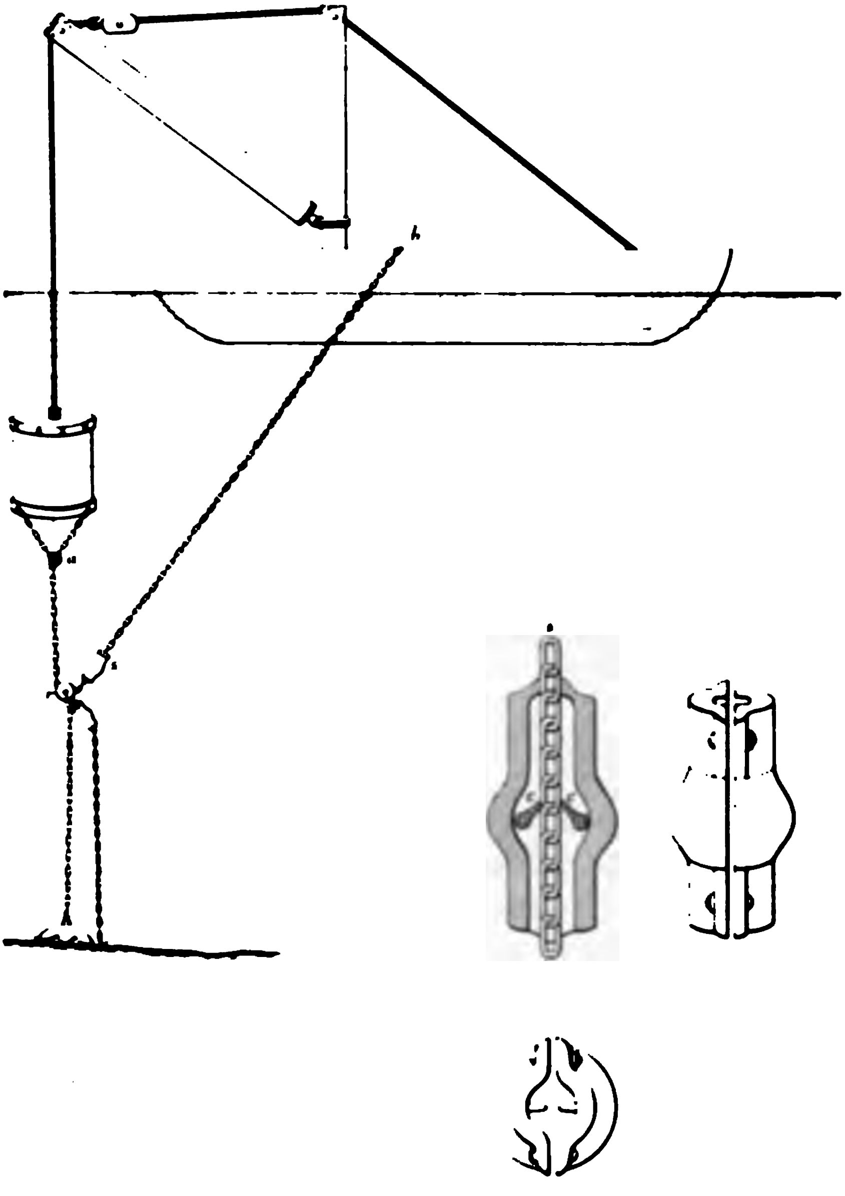


PILE TORPEDO.

Fig 10



AUSTRIAN MANNER OF LAYING TORPEDOES.



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lished the efficiency of 45 lbs. and 50 lbs. charges for torpedoes constructed in the manner last described, no increase of the same is required. At the same time, it has been deemed expedient to increase the size of the torpedo to 50 inches by 15 inches for the purpose of adjusting to it at least five points of explosion. But as a charge of 50 lbs. powder would not be sufficient to fill a keg that has diameters of 20 inches and 16 inches, the powder would unsteadily roll in the barrel, following its every motion which may be caused by the current.

For this reason, also, the air-chamber, around which the charge (*d d*) becomes more firmly packed, seems to be advantageous.

The explosive apparatus here described may also be used for torpedoes attached to frames (see fig. 9, Plate IX.), or to piles (fig. 10). Fig. 11 shows its application to a land torpedo.

Here it may not be out of place to state that the fuze invented by General Raines was with good success also used for hand-grenades, which, being of an elongated form, but very seldom failed to strike point forward, and to explode.

CHAPTER XV.

Toopedoes fired by Electricity.

PREVENTED by a vigorously enforced blockade to procure the most essential requisites, in either sufficient quantity or quality, Southern engineers have had during the war but little opportunity of gaining experience in the application of electricity as a means by which to fire torpedoes. Scarcity of insulated wire or cable alone would have excluded the possibility to use torpedoes which were to be fired by electricity in any other but exceptional cases. So called boiler-torpedoes were placed in James River below Richmond, also in deep channels near Charleston, Wilmington, Savannah, and Mobile. The *New Ironsides* remained, during the first attack on Fort Sumter, a full hour over one of these boiler-torpedoes, but was saved from sharing the fate that afterwards befell the *Patapsco* in the same waters by a defect in the cable. Wilmington, Savannah, and Mobile were evacuated before the Federal vessels had approached the places where torpedoes of this class had been sunk; it is therefore impossible to judge whether these heavily charged torpedoes would have exploded or not, and what might have been the effect of their explosion.

As, however, one of the Federal gun-boats, the *Commodore Jones*, was sunk by one of these torpedoes on James River, a description of the battery used is given here :—

The galvanic batteries were formed of nine zinc cups, each one battery or set of cups being placed on shelves directly over the other. In each zinc cup was placed a porous clay cup. In the zinc cup, and outside the porous cup, was placed the diluted sulphuric acid, and inside the porous cup was placed the nitric acid. The zinc of one cup was connected to the cast-iron of the other by a clamp and thumb-screw. The negative wires led directly to the torpedoes (one to each). The positive wires ran along the bank of the river and terminated at a sub-battery. In this sub-battery were two large wooden plugs, with a hole about one-half inch diameter in each; these holes being filled with mercury, the positive wires from the charged batteries being inserted in the mercury at the top of its respective plug to form the connection and explode the torpedo. The wires from the river-bank to the torpedoes were supported by a three-inch rope, being stopped to rope about every 4 feet. At a distance of every 15 feet of the rope was some 5 or 6 feet of three-quarter link chain to assist in keeping it on the bottom. The wires were covered with gutta percha about one-quarter inch thick.

The operator was concealed in a box inserted in the ground about 4 feet square. The torpedo was exploded by applying one of the wires leading through the plug to the charged wire.

Below Mobile a few torpedoes intended to be fired by electricity were sunk in Choctaw Pass and in Spanish River channel. The cables were connected with an electro-magnetic machine that had been brought to Battery Gladden.

The charge was to be ignited by the incandescence of the wire.

Experiments having established the practical applicability of the direct magneto-electric current as a means of effecting the ignition of gunpowder or gun-cotton, two kinds of torpedoes have of late been proposed, which do not only differ from the above described torpedo in reference to effecting the ignition of the charge by an induction-spark instead of by the incandescence of the wire, but also in being by contact self-exploding.

(*a.*) *The Austrian Torpedo.* The ignition of the charge is effected by the induction-spark of an extra-current, which, when a vessel strikes the torpedo, is produced by a galvanic battery and bobbin on shore. Each torpedo being, by i own wire, connected with the battery, connection may l interrupted or re-established at will. For greater safety tl Austrians require, besides, that the fuze in the torpedo (tl well-known Ebner-fuze) be brought in contact with the circui wires only at the moment in which the ship strikes the torped and even then by the shock alone. They further consider tl opening spark only (that which is produced instantaneous with severance of connection), not the closing spark, of a induction current as serviceable for the ignition of a fuze.

On these principles is based the following very complicate mechanism :—

The torpedo-case has a double top. No great stress is lai on a perfect exclusion of water from the flat chamber, which thus formed :—

The side of the chamber has a slight reenforce ; through i reach nine buffers, standing out about six inches. These ar pressed outwards by spiral springs. To push them in, a weigh of about 50 pounds is required. Each of these buffers touche a cog of a bronze wheel, which moves horizontally in th middle of the chamber. This cog-wheel is pressed by a spira spring against the buffers. (Plate X., fig. 1.) Where the enter the chamber, these buffers (fig. 2) are enclosed in a wrapping of caoutchouc, which is pressed against the side of th torpedo by a ring that is screwed in and a piece of caoutchou covering. In this complicated way the chamber is rendere water-tight, at least to a certain extent.

The axle of the cog-wheel enters through a stuffing-bo (fig. 3) the interior of the torpedo proper. At its end it supports here the mechanism for establishing or interruptin connection of the electric current with the fuze.

Within a square a cylindrical continuation, insulated b ebonite, is attached to this end of the wheel-axle. This continuation consists of two halfs, insulated from each other, an reaches down through the cover of the stuffing-box (fig. 3)

On the lower side (the one facing the interior of the torpedo) of this stuffing-box is the contact-mechanism. A brass-arm (*a*) (fig. 4) is fixed to the above-mentioned insulated continuation of the wheel-axle, to which are also attached four elastic steel-strips (1 – 4).

To the edge of the box are fastened four contact-pins (α, β, γ, δ) (figs. 4, 5, and 6) and a spring-catch (ι) (fig. 7) which is so arranged that it is depressed when the arm (*a*) moves over it.

Fig. 4 indicates the position of the axle with its five arms opposite the contact-pins when in a state of rest. The contacts (β and δ) hold the two extremities of the fuze-wires (P β, P δ); the contact (γ) receives the cable from the battery, and contact (α) leads to the exterior side of the torpedo, that is into the water, as also the spring-contact (ι).

In this position no galvanic or other current passes. The fuze is in no contact whatever with the circuit-wire, and does not even touch it with its terminals. Austrian electricians consider this a necessary precaution against danger from lightning striking the wire, whereby the explosion of the torpedo might be caused. With charges resting under water this precaution, however, seems to be superfluous.

Fig. 5. When a vessel strikes against one of the buffers, the axle of the cog-wheel commences to turn, and the contact-apparatus takes the position indicated in fig. 5. The elastic strips (1 and 3) strike against (α and γ), and the arm (*a*) against the spring-catch (ι) which is depressed by it. The current (which after the momentary closing induction current has ceased is changed into an ordinary current, that would not ignite the fuze even if it passed through it) enters at (γ), and passes through (3, *a*, and ι) into the water.

If a still greater pressure is exercised by the vessel on the buffer the position indicated in fig. 6 is taken.

The elastic steel strips (2 and 4) strike against the fuze-contacts (β and δ), and connect them with the circuit, as the strips

(1 and 3), which now are a little bent, continue to close at (α and γ.)

The current enters at (γ) and passes again through (3, a, and ε) into the water. It would pass through (γ, 3, 2, β fuze, δ, 4, 1, and α) into the water, if it had tension enough to pass the break in the fuze, when contact at (α and ε) ceases.

But this occurs one moment later when the strips (2 and 4) strike against (β and δ); the arm (a) passes at once over the spring catch (ε), and the passage of the current into the water is at the same moment stopped.

But as an interruption in the current produces an induction-current in the same direction, such a one is created at once, and the consequence is, that a spark shows itself at the place where the connection is interrupted in the fuze, and by it the fuze is ignited and the torpedo exploded.

This is the contact-mechanism; very ingenious, it is not less complicated.

As above-mentioned, every torpedo has its own cable. Each cable terminates in a binding-screw, and all or several of these screws are attached to a brass bar that is connected with one pole of the battery. The other pole of the apparatus is conducted into the water, which, therefore, is in connection with the water-end of each fuze-wire. As only that torpedo against which a vessel strikes is brought in connection with the apparatus, it is evident that from this arrangement no loss in the current can accrue.

But if a torpedo out of the number of those which converge into one apparatus is exploded, it is evident that an extremity of bare wire takes its place in the water, and the current passes continually through.

It is therefore necessary at once to detach the cable of the exploded torpedo from the bar.

For the discovery of which cable is leading to an exploded torpedo, and also for the testing of the integrity of the cables, the Austrians propose the following apparatus:—

The apparatus consists of a galvanic chain (*C′*) (fig. 8), composed of many abnormally large Smee's elements, and an induction-spiral (*F*).

This spiral is wound around a bundle of wire, and forms part of the circuit. The current enters from the induction-spiral through the galvanoscope (*a*) the bar (*h h*), which by means of the handle (*H*) (fig. 9) can be quickly raised, and be placed out of connection with the keys (*t t t*). For this purpose the plate (*h h*) (fig. 9) has on its lower side attached to it the insulating plate (*i*), which touches the keys when the lever (*H*) is pressed down.

Each of the keys contains a disconnecting stopper (*S*), and a binding screw (*K*), to which the cable leading to the torpedo in question is fastened.

When, then, a torpedo—for instance, No. 3—is touched, the current passes through *C*, *F*, *a*, *h*, t^3, wire^3, and torpedo^3 into the water. To the keys are also attached the wires (*d d d d*), &c., which lead to the arc-shaped insulator (*e e*), where they end in a button. On this insulator the numbers of the several torpedoes are marked. A metallic hand (*Z*) slides on these buttons; from its metallic axle the wire (*f*) leads to the weak galvanic chain (*C″*). The other pole of this chain is in connection with a second galvanoscope (*b*) and with the water.

A torpedo having exploded—for instance, No. 3—the lever (*H*) of the bar (*h h*) is quickly pressed down, whereby the exploding apparatus (*C* and *F*) is placed out of connection.

The hand (*Z*) is now moved over the buttons on (*e e*), whereby connection with all torpedoes, one after another, is established; as their fuzes, however, are still without the circuit, no explosion can take place.

Whilst the hand (*Z*) is being turned, the galvanoscope (*b*) is to be observed. So soon as the hand (*Z*) touches the button of the wire leading to torpedo^3 the circuit is closed, the current passing through *b*, *f*, *Z*, d^3, t^3 into the cable of torpedo^3, and through its bare end into the water.

This is indicated by the needle of the galvanoscope (*b*).

The stopper (*S*) is removed from the key[3], the bar (*h h*) is replaced in its former position on the keys, and the hand (*Z*) is pointed on zero (insulation), whereby the state existing before the explosion is re-established. When (what generally will be the case) a larger number of torpedoes have been placed, from eight to twelve are united into one group, to the number of the groups thus formed the number of bars (*h h*) will then have to correspond.

These groups are also marked on the insulator (*c c*). A small electro-magnet is placed in the cable leading to each bar; it attracts its anchor whenever a torpedo belonging to the group whose cables converge in one bar explodes. A small trap is opened by the magnet attracting its anchor, and the attention of the operator is at once directed to the group in which an explosion has taken place.

The above-described process is now applied to that bar with which the cable of the exploded torpedo is in connection.

2. (See figs. 1 and 2.) Another self-exploding contact-torpedo has been proposed, the construction of which is much more simple, because the principle involved does not suppose the necessity of keeping the fuze without the circuit previously to the moment when the torpedo is struck by the vessel.

The contact mechanism is placed in a flat chamber, as is also the case with the Austrian torpedo. In this chamber is fastened a cross made of metal, and by small blocks insulated from the case of the torpedo.

From the centre of this cross an insulated wire leads into the fuze; the second fuze-wire leads out of the torpedo into the water. At the end of each arm of the cross a deep metallic cup is placed, into which a wooden buffer reaches, without, however, touching the cup. The buffer passes through a ring of thick caoutchouc, that, being attached to the torpedo by screw-rings, supplies the place of a stuffing-box in a simple and efficient manner.

Of these buffers there are four (b^1, b^2, b^3, b^4); they will touch the cup into which they reach at some point, when a direct or lateral pressure is exerted on them.

Each buffer has a small brass cap attached to the end which enters the cup. These four caps are connected with each other and with the cable leading to the battery by the very pliable and fine insulated wires (*c c*).

When, then, a vessel presses, for instance, buffer^2 into its cup, the current would pass from the cable (*a*) through (b^2) into the cross, thence into the fuze, and back through the water.

The ignition of the fuze is effected by the induction-spark; the apparatus used is that of M. Ruhmkorff.

An arrangement similar to the one above described is used for finding out which torpedo has exploded, and which cable is to be detached from the bar.

For this purpose the exploding apparatus itself is used; the test-hand (*Z*) may be put in or out of connection by means of the simple stopper arrangement (*b*).

A special test-battery is not necessary, as the circuit is only completed when a pressure is exerted on the buffers of the torpedo.

For the connection of the cables with the induction-apparatus (*R*), the bar (*S S*) is used; it is similar to the bar (*h h*) above described. By raising this bar, and inserting the stopper (*b*), only that cable is connected with the induction-apparatus which is indicated by the number to which the hand (*Z*) points.

(*G*) is a galvanoscope which indicates the exploded torpedo.

To test the integrity of the cables before an explosion has taken place, it will, with either of the described arrangements, be necessary to exert a pressure on the buffers of that torpedo the cable of which is to be tested.

It must be granted that the torpedo described under No. 2 is not less ingenious, and by far of a more simple construction than the Austrian self-exploding contact-torpedo. In either, however, principles are involved that are based on a combination of mechanics with electricity, from which results an apparatus, the complicatedness of which must leave serious doubts in regard to the absolute certainty of explosion after such a self-exploding contact-torpedo has remained in the water for a certain length of time.

That the cost-price of this class of torpedoes must be very considerable is evident.

The peculiar advantage of the electric torpedo over all self-exploding contact-torpedo consists in its not interfering with the passing of friendly ships. The electric self-exploding contact-torpedo even may be rendered perfectly harmless by temporarily breaking its connection with the battery.

For this reason the electric torpedo is the only one that could be used for the defence of a gap in a line of obstructions, which it has been necessary to leave for the passing in and out of the vessels of the national fleet.

Another advantage of the electric torpedo is the certainty of its explosion, even after the torpedo body has become embedded in sand or mud.

The self-exploding contact-torpedoes just described would in such a case not be of any value, nor do they promise to lead in localities where marine worms are very destructive to any better results than those which were obtained with Singer's torpedo in Grant's Pass and the Bay of Mobile.

The necessity of sinking the cables to a depth that will protect them against being torn or otherwise injured by a vessel passing over them, would fairly indicate that electric torpedoes should be used for the defence of deep channels only.

When it is required to defend a channel which is not deeper than 20 feet, the cable will have to be sunk to the bottom of the channel: in deeper channels the cable should be placed at least 26 feet below the surface.

How necessary it is to test from time to time the integrity of the cables leading to the several torpedoes may be understood from the fact that the *New Ironsides* remained for fully one hour over a heavily-charged electric torpedo, whose explosion was prevented by a defect in the cable.

The following objections may be urged to the electric self-exploding contact-torpedo.

1. Electric torpedoes being most suitable for deep channels, and for the defence of gaps in lines of obstructions, it may be assumed that the electric self-exploding contact-torpedo could most advantageously be used for the purposes of

(*a.*) Defending a deep channel when, especially if the torpedo is placed on the bottom of the channel, sand and mud, marine worms, and sea-weeds would not be long in interfering with the self-exploding arrangement of the torpedo in a manner which, after all, would require the torpedo to be fired from the battery on shore.

(*b.*) Defending a gap in a line of obstructions.

Obstructions, as in a preceding chapter has been said, should always be established within effective range of shore-batteries. The gap left in the line of obstructions for the passing in and out of friendly vessels is, therefore, so near to the shore that the exact position of a vessel passing the gap during day-time may be ascertained without fail. In this case, an electric torpedo fired from the battery on shore would in its effect be just as unerring as a self-exploding contact-torpedo.

That the enemy should undertake to force a passage through the gap during a dark night or foggy weather may be possible, but is not likely. If the strength of a squadron stationed at a blockaded port is such as to justify the running out of the squadron, and risk an engagement with the enemy beyond the range of the shore-batteries, it would appear that the squadron is also adequate to the task of preventing the enemy's ships from forcing a passage through the narrow gap in the line of obstructions during a dark night.

2. Electric self-exploding contact-torpedoes are very complicated and very costly.

3. They can hardly have any greater effect than the friction-torpedoes described in Chapter XIV.

4. They are liable to get out of order after having remained in the water for a certain length of time.

5. They require much adroitness and time in being placed, while other self-exploding contact-torpedoes may be placed at the rate of four and five in one hour.

These are some of the reasons on which American engineers are basing their objections to electric self-exploding contact-torpedoes. As above mentioned, electricity will be the only suitable means by which to fire torpedoes placed on or very near the bottom of a channel, or in a gap in a line of obstructions. For all other purposes, however, we should prefer the torpedo described in Chapter XIV.

The extra sums of money, the time and labour expended in the fabrication of these electric self-exploding contact-torpedoes would, according to the idea of American engineers, be more judiciously employed towards the establishment of a thorough system of lighting up the channel and water approaches.

In connection with the subject of firing torpedoes by electricity, we give here the following extract from a very interesting memoir by Professor Abel, F.R.S. (See Plate XI.)

"In the first experiments on this application of the magneto-electric current, a very large powerful magneto-electric machine was employed, which had been constructed by Mr. Henley (and had been exhibited by him at the Paris Exhibition in 1855). The principle of this instrument was precisely the same as that of the machine devised by Mr. Wheatstone for ringing magneto-electric bells. Its armature, instead of being rotated, was suddenly detached from the magnet by means of a lever. It was soon established by a few experiments, that, even with this instrument, gunpowder itself could not be ignited with any degree of certainty. Results obtained with Statham's and other fuzes, though superior to those furnished by gunpowder alone, were still far from satisfactory. The first efforts were therefore directed to the discovery of a suitable agent to serve as a perfectly certain medium (or priming material) for effecting the ignition of charges by means of the magneto-electric machine. For this purpose a variety of compounds and mixtures of a more or less sensitive character, were prepared for trial with the magnet.

"Many of these compositions furnished results to a certain extent favourable, a number of fuzes primed with them having been fired in succession with the magnet, and from two to four charges in one circuit having been ignited, in a very few instances. But no perfect certainty of discharge was attained with any one of the materials used, the attempt to fire a fuze being frequently unsuccessful, while no difference between it and a successful fuze, containing the same composition, could be detected by a careful examination.

"Some successful results, obtained accidentally with one of the experimental compositions, which had become damp by exposure to air, led to a trial of the effect of moisture in promoting the ignition of but slightly sensitive compositions, and it was ultimately found that the impregnation of ordinary gunpowder with a small amount of moisture (by an expedient similar in principle to one adopted with considerable success by Captain Scott, R.E., in connection with charges to be fired by the induction-coil machine) rendered its ignition by means of the magnet a matter of certainty.

"Some important precautions were, however, indispensable to the attainment of this definite result. If the slightly damp powder was employed in a finely divided condition, it very frequently became caked between the wire-terminals in the fuze, and the current would then pass through the composition without igniting it. This was found to take place occasionally even when the powder was employed in its original granular condition. Several attempts were made to overcome this difficulty by modifying the form and position of the terminals or poles in the fuze, and I at last contrived a perfectly successful arrangement, in which only the sectional surfaces of the terminals, consisting of fine copper wire (0·22 inch diameter), were exposed in the interior of the fuze (see fig. 5, Plate XI.) so as not to project at all. The prepared gunpowder, therefore, simply rested upon the surfaces, and a perfect uniformity in the action of the fuze was attained. The priming composition consisted of fine-grain gunpowder, which had been soaked in an alcoholic solution of chloride of calcium of a strength sufficient to impregnate the grains with from one to two per cent. of that salt. The prepared powder was exposed to the air for a short time, to permit of a sufficient absorption of moisture by the deliquescent salt. Upwards of 500 quill-fuzes (of the description employed for firing guns), primed with the prepared gunpowder, and fitted with the arrangement of the terminals above referred to (fig. 5, Plate XI.), were fired with the larger lever-magnet. The failures did not amount to more than 3 per cent., and were all proved to be due to defective manufacture. In the experiments with these fuzes, one or two simple rheotomic arrangements were successfully employed for effecting the rapidly successive discharge of a series of fuzes.

"The above fuze was found to be easy of manufacture and permanently effective. While, however, it presented a certain means of effecting the ignition by the aid of a powerful magnet, of single charges, or of a large number to be fired in moderately rapid succession, it was inapplicable to the ignition with certainty of more than one charge in circuit. After a great number of experiments, I at length succeeded in the production of a priming material for the fuze which greatly exceeded in sensitiveness any of the other compositions hitherto tried.

"The new priming composition consisted of a very intimate mixture of sub-phosphide of copper, chlorate of potassa, and levigated coke, the latter substance being employed to add to the conducting power of the mixture, which was found otherwise to be insufficient.

"In the course of experiments subsequently carried on with fuzes which contained this composition, it was found that a slight residue, consisting principally of the coke employed, occasionally remained on the surfaces of the terminals in the fuze after its discharge, and by forming a good conducting link between them, interfered with any future effects of the magnetic current in other directions, by the establishment of a complete circuit. This obstacle to the perfect success of the composition was entirely removed by the substitution for the coke of another material, more easily acted on by the chlorate of potassa and answering equally well as a conducting medium, namely, the sub-sulphide of copper. No instance has occurred in the discharge of several thousand fuzes, primed with the mixture of sub-phospide and sub-sulphide of copper with chlorate of potassa in which the terminals have not been found quite free from adherent residue after the ignition.

The sub-phosphide of copper, which is produced at an elevated temperature, is a compound of very stable character, and the mixture of the three constituents is quite as unalterable as the explosive mixtures which are in general use for the preparation of percussion-caps, &c. The stability of the mixture has already been submitted to very satisfactory tests. Fuzes primed with it have been found to have lost none of their delicacy and certainty when tried more than two years after preparation. The sub-phosphide of copper, intimately blended with chlorate of potassa, forms a mixture in a high degree sensitive to the effect of heat, and possessed, at the same time, of some power of conducting electricity. With the employment, however, of magneto-electric machines of comparatively low power, and in cases where the resistance to be overcome by the current is considerable, this conducting property is not sufficient to ensure the ignition of the mixture by assisting the passage of the current across the interruption in the metallic circuit (*i.e.* across the small distance between the terminals of the wire in the fuze). It must be borne in mind that the striking distance, or the space between the terminals across which the current from even a powerful magneto-electric machine will leap, is very small. With the large lever-magnet, the spark could only be produced when the wires were almost in contact. Since, however, it is indispensable to the proper insulation of the wires in the fuze-arrangement that the terminals should be at least one-sixteenth of an inch apart, it will be readily understood how essential to success, in operations with these machines, it is that the priming material should possess considerable conducting power. Hence the necessity of increasing the conducting power of the mixture of sub-phosphide of copper and chlorate of potassa; a result which, it has been already stated, was obtained in the first instance by the employment of finely levigated coke, and afterwards by the substitution of sub-sulphide of copper for that substance. Many experiments were, of course, required to determine the proportions in which it was advisable to employ the conducting constituent, so as to facilitate the passage of the current through the mass as far as possible, without interfering too much with the sensitiveness of the explosive mixture, or producing an almost perfectly continuous connection between the two poles in the fuze, and thus promoting the passage of the current so greatly as to prevent the ignition of the composition.

"The fuzes contrived by me for use with magneto-electric apparatus are of two kinds—the one being adopted for mining purposes and the other for firing cannon. The fuze for mining purposes (fig. 6^a, Plate XI.) consists of:—

"(*a.*) A head for receiving the wires which connect the fuze with the magnet and the earth. (Fig. 6^b, Plate XI.)

"(*b.*) Of the insulated wires, with the terminals of which the priming material is in close contact.

"(*c.*) Of a small cartridge or charge of powder, enclosing the terminals, upon which the sensitive composition rests.

"The wooden fuze-head contains three perforations (*a a*, *b b*, *c c*) (fig. 6^b, Plate XI.); the one passing downwards through the centre receives about two inches of double insulated wire.

The other two perforations, which are parallel to each other on each side of the central one, and at right angles to it, serve for the reception of the circuit-wires. The arrangement for securing the connection of these with the insulated wires in the fuzes is as follows:—

"The piece of double-covered wire above referred to is originally of a sufficient length to allow of the gutta-percha being removed from about 1½ inches of the wires. These bare ends of the fine wires, which are made to protrude from the top of the fuze-head (*a*) (fig. 6^{a}, Plate XI.), are then pressed into slight grooves in the wood provided for the protection, and the extremity of each is passed into one of the horizontal perforations in the head, in which position it is afterwards fixed by the introduction into the hole of a tightly-fitting piece of copper tube, so that the wire is firmly wedged between the wood and the exterior of this tube, and is thus at the same time brought into close contact with a comparatively large surface of metal. It will be seen that it is only necessary to fix one of the circuit-wires into each of these tubes in the opposite sides of the fuze-head, in order to ensure a sufficient and perfectly distinct connection of each one of them with one of the insulated wires in the fuze.

"The phosphide of copper fuze for firing cannon (fig. 6^{c}, Plate XI.) differs somewhat in construction from mining fuze. The head is somewhat longer, and of such a form that the double-covered wires are completely enclosed in it, the lower extremity of its central perforation still remaining free to receive the top of the quill or copper-tube, which is charged with gunpowder in the same manner as the ordinary tube-arrangement for firing cannon. The plan originally suggested by M. Savare, of arranging the charges in divided circuits, was next tried, and furnished far more successful results. The simultaneous ignition of twenty-five charges was repeatedly effected; and forty charges were similarly exploded on several occasions. These results were all obtained with the large magnet constructed by Henley, the current being established by rapidly separating the armature from the poles by means of a lever. By a simple arrangement for shifting the connection of the main wire with the exploded charges from them to a second series, similarly arranged, twenty-five were almost simultaneously ignited on allowing the armature to return to the poles of the magnet.

"The system of firing charges by means of magneto-electricity, with the aid of the phosphide of copper fuze, having been thus far successfully developed, a series of experiments was instituted at Chatham for the purpose of thoroughly testing its certainty and applicability in the field, and subsequently for ascertaining the extent to which it admitted of application to the explosion of submarine charges. These experiments extended over a period of six months, and were performed under various conditions of weather. It will readily be understood that the best and most simple method of connecting the fuzes, enclosed in the charges, with the branch-wires and the earth, of arranging the experimental charges for explosion, and of carrying out the various small but essential details involved in the operations, were only gradually arrived at; and that, consequently, in many of the first experiments, which were only partially successful, the failures were traced to causes unconnected with the efficiency of the magneto-electric apparatus or the fuze. It would be superfluous to enter into details with regard to these preliminary experiments, however important they were at the period of the investigation. The description of the operations at Chatham will, therefore, be confined to those which were carried on according to the plan which was ultimately proved to be most efficient. The magneto-electric apparatus employed in all the field experiments was Mr. Wheastone's arrangement of six small magnets, the whole apparatus having been enclosed in a box, so that the only exposed portions were the binding screws for the attachment of the wires, a handle for setting the armatures in motion, and a key, by the depression of which, at a given signal, the circuit could be completed.

"To employ the instrument at any moment, only the following operations were necessary :— The insulated wire and the copper wire passing to the earth were fixed to the apparatus by means of binding screws; the instrument was raised from the ground by being placed on its packing case; at that height a man could operate with it when in a kneeling posture. At the signal, 'Ready,' the handle was turned with one hand so as to cause the armatures to revolve with the greatest possible velocity, whilst the other hand was pressed against one corner of the instrument close to the key, so as to steady the box and to be ready, at the signal 'Fire,' to depress the key with the thumb. The connection of the instrument with the earth was effected as follows : A moderately clean spade was selected from among those used by the men in digging holes for the charges. One end of a piece of stout copper wire was placed under the edge of the spade, so that when the latter was firmly forced into the ground, the wire was pressed by the earth on both sides against the iron surface. The protruding wire was wound once or twice round the bottom of the spade-handle, and then attached to the binding-screw of the magnet.

"The gutta-percha-covered wire used in the experiments having been in occasional service at Chatham for some years, the coating had sustained some injury in two or three places. Such defects were protected from possible contact with the earth by means of waterproof cloth or sheet india-rubber. The total length of wire used was 881 yards, of which 600 were extended, lying along the ground.

"To the extremity of the covered wire a number (from 12 to 25) of pieces of similar insulated wire, varying in length between three and six yards, and serving to connect it with the individual charges, were attached in the following manner: - About six inches of the extremity of the main wire and of each of the branch wires were laid bare and cleansed ; the end of the former was then surrounded with those of the latter (placed in an opposite direction), and the whole tightly twisted together by means of pliers, so as to be brought thoroughly in contact with each other and with the main wire. The twisted wires were then bound round with moderately fine copper wire, which was made rigid with pieces of stick tied against it, and the whole securely enveloped in a piece of waterproof cloth or canvas, to protect it from damp and contact with the earth.

"These connections, though of a very rough description and most readily prepared by any soldier, were thoroughly effectual. No instance occurred, in the whole of the experiments, of the failure of a charge which could be attributed to an imperfect connection of its branch wire with the main wire.

"The following was the method adopted for connecting the fuzes with their respective branch wires and with the earth :—

"The fuzes, as they were manufactured, were always fitted with two pieces of covered wire twisted together (fig. 6^d), which were tightly fixed into their proper positions by forcing a short pin of copper wire into the holes of the fuze-head. They were thus ready for insertion into the bag or other receptacle containing the charge of gunpowder, the ends of the covered wires protruding from the opening of the latter to a convenient distance for effecting the junction with the branch and earth-wires. The extremities of one of the fuze-wires and of a branch-wire (from both of which the gutta-percha was removed to a distance of about two inches) were connected by hooking them firmly one in the other with pliers (in the manner shown in fig. 6^e). A piece of fine copper binding-wire was then twisted over the whole of the connection, and the joint was finally enclosed in a small wrapping of oiled canvas, in a manner similar to that adopted at the principal junction with the main wire.

"The extremity of the other fuze-wire was attached to an uncovered copper wire, of sufficient length to bring the whole of the charges into connection with each other in this manner. The wire was fixed in a convenient position by being twisted round short stakes or pickets driven into the ground, and its extremities were buried in the earth, being attached either to spades, as already described, or to zinc plates about eight inches square.

"The experiments instituted at Chatham, with the object of applying the magneto-electric current to the ignition of submarine charges, were attended with greater difficulties than those which served to test the system in its application to land operations; nevertheless, the results ultimately attained were also of a character to lead to definite and favourable conclusions.

"The method of establishing the connections of a charge with the wire and the earth differed naturally in some respects from the mode of proceeding already described. The charges of powder were contained in canisters of block tin, carefully soldered so as to be water-tight.[*] The fuze, with two wires attached as before, the one a few inches longer than the other, was inserted into the charge, and fixed in its proper position in the canister by means of a loose-fitting bung (see fig. 7, Plate XI.), pushed a little distance into the neck, and cut out on one side, so as to admit of the longer insulated wire, while the bare part of the shorter wire was firmly pressed by the cork against the inside of the neck. The latter was then completely filled up with melted gutta-percha, and the extremity of the short uncovered wire was bent back over its side, so as to be in close contact with the metal surface. In this manner, the enclosed fuze was brought into good metallic connection with the wet earth or water by which the canister was surrounded. The insulated wire projecting from the mouth of the canister was connected with one of the branch wires in the manner already described; but in order thoroughly to protect the connection from the water in which it would become immersed, a piece of vulcanized india-rubber tubing, of suitable length, and a tin tube, rather longer and wider than the latter, were slipped on to the branch wire before it was joined to the fuze-wire, and, when the junction had been effected, the india-rubber tube was pulled over it, and tied very firmly at both ends on to the gutta-percha covering of the wires (fig. 8). A small quantity of a cement (consisting of beeswax and turpentine) was rubbed in between the latter and the ends of the india-rubber tube, so as thoroughly to ensure the exclusion of water, and, finally, the tin tube was pulled over the joint and fixed (by compressing the ends), for the purpose of imparting rigidity to the junction, and thus protecting it from injury by any sudden twist or strain. By these arrangements, when carried out with moderate care, the perfect exclusion of water from the charge, and from its connection with the branch wire, was effected.

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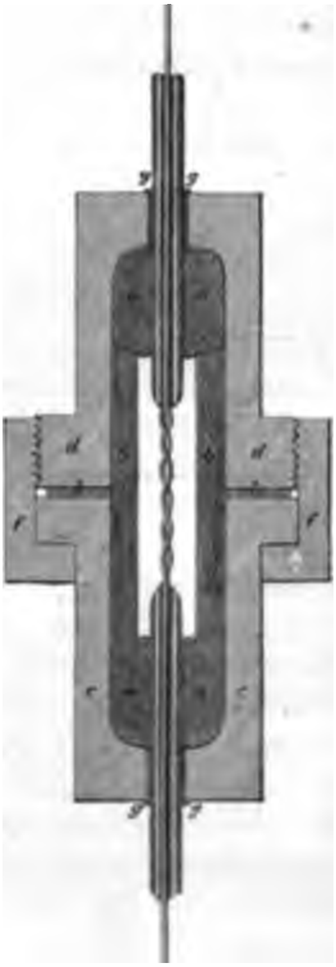
[*] Any vessels of this material, such as turpentine-cans, may be employed, provided they be perfectly coated inside with marine glue, or some other description of varnish.

The first trials of these charges were made in a shallow canal with a mud bottom, and from which, at the time of experiment, the water was receding so rapidly, that before the whole of the charges had been immersed, several of them were exposed to view, being partly embedded in the mud. Twenty-five charges were arranged, of which thirteen were exploded, though less rapidly than in the experiments on land. On the next occasion, when twenty-five charges were entirely surrounded by water (simply resting upon the firm bed of a pond of some depth), only four of the charges were exploded. Several other attempts were made to fire a smaller number of (ten and five) charges, similarly immersed, but in every instance only four were ignited. A careful examination into the cause of the invariable explosion of so comparatively limited a number of charges under water led to the following explanation :—

It will be remembered that the explosion of numerous charges in a divided circuit by the magneto-electric apparatus with revolving armatures is effected by the action of an exceedingly rapid succession of currents. The rapidity with which they follow each other, however great, cannot equal that with which the terminals of a fuze, enclosed in a small charge under water, come into contact with the latter after the explosion. The instant this occurs, a complete circuit is established through the water, and any further action of the current is at once arrested. By the time, therefore, that four charges had been ignited in extremely rapid succession, so as to be apparently exploded at once, a sufficient interval of time had in reality elapsed to allow the water to re-occupy the space filled for a brief period by the gaseous products of the first explosion, and thus to rush in upon, and complete the circuit with, the terminals of the fuse. It appears probable that, with the employment of larger charges of powder (about eight ounces was the quantity exploded in each charge) when the volume of water displaced by the explosion would be more considerable, a great number of charges would be exploded before the circuit could be completed by the water."

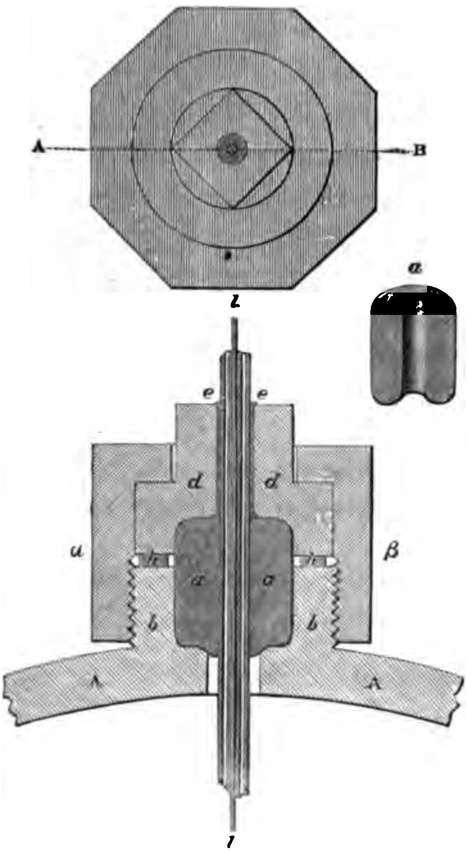


Method of splicing Torpedo-cables.

Mr. R. Sabine, of London, whose great experience in establishing telegraph-lines places him among the authorities on kindred subjects, recommends the following method for splicing submarine cables of small size:

"The wrapping is removed from the two ends of the wires, which, laid bare about three inches, are then connected (if possible, soldered). Previously to joining the wires, a well-fitting caoutchouc ring (*a a*) is slid on each end, and on one end the elastic tube (*b*) and the small boxes (*c* and *d*) turned in bronze, are placed. These boxes press loosely against the surface of the cable by means of the india-rubber (*g g*). The projecting rim of the box (*d*) has screw-threads, in which turns the mother-screw of the box (*f f*). Between the boxes (*c* and *d*) the caoutchouc ring (*h*) is placed. After the wires have been connected, the boxes, and with them the india-rubber rings, are slid together, and (*f f*) is screwed tight. Hereby the rings (*a a*) are compressed and close the space between the cables and the openings of the ebonite tube (*b*) so securely as to ensure perfect insulation.

Method of introducing the Cable into the Torpedo.



The introduction of the cable into the torpedo will be understood from the accompanying sketch. If we are rightly informed, this also has been suggested by Mr. R. Sabine, of the house of Messrs. Siemens and Halske, London and Berlin.

(*A A*) envelope of the torpedo, carrying a small collar (*b b*), (*l l*) insulated cable, (*d d*) stuffing-box, (*e e* and *h h*) caoutchouc rings, (*a a*) thick caoutchouc ring, which is compressed by the tightening of the screw of (α and β), thereby effecting a permanent insulation of the cable (*l l*).

CHAPTER XVI.

Torpedoes which are not Self-exploding Contact-Torpedoes require an Apparatus for Observation.

IT is obvious that it must be just as essential for the operator on shore to ascertain the exact position of the vessel which he intends to destroy by his torpedo, as it is necessary for the artillerist to give his piece the required direction and elevation before firing on the vessel which is approaching his battery.

The older ones of the many methods that exist for taking observations of this class we may safely suppose to be known, and turn, therefore, our attention at once to three very ingenious systems of more recent origin:—

1. The Abel-Maury system. (Plate XI., fig. 3.)

The distinguishing feature of this system is, that the exact positions of the sunken torpedoes being first indicated by buoys, their azimuths are taken, and then marked on the horizontal circle of two telescopes placed at convenient stations.

If the position of the torpedo does not change, the lines of sight of the two telescopes will intersect each other at the exact spot at which the torpedo has been sunk, so soon as the index F' and F'' point to the corresponding mark.

The telescopes are connected with one another, and the torpedo with the telescopes by a cable. This cable is connected with a battery E, and with the keys (a and b), by means of which, at each station, connection is established or broken at will. The contacts on the telescopes are formed by the hands themselves; they not only indicate the number of the torpedo at which the telescope is sighted, but also close the circuit to the torpedo in question. Each observer, keeping his key depressed, follows with his telescope the movements of the enemy's vessel.

An explosion occurs, of course, only when the circuit is closed, and this can be the case only when the vessel has arrived over a torpedo, or in its immediate vicinity.

When there are many torpedoes, or when the stations are far apart, the intervals between the single contacts on the horizontal circle are very small, and the whole apparatus becomes inaccurate. By making the horizontal circles very large —for instance, three feet in diameter—greater accuracy may be secured. It is also proposed to establish three or more stations in order to prevent embarrassment in case the enemy should succeed in destroying one or more stations. The cables have then to be arranged accordingly.

2. In the second method (Plate XI., fig. 4), two stations are also required; they are established at points as little conspicuous as possible. Each station is provided with an olhidode or telescope with which to observe approaching vessels; also with an index by which the corresponding torpedo may be placed in connection with the battery.

The battery is placed at one of the stations. After the torpedoes have been placed, they are marked by buoys. The lines of sight towards the torpedoes are then marked on the ground before the stations by coloured flags. The length of the arc in which these flags are placed will depend on the distance of the torpedoes from the station; on the distance of the two torpedoes, placed at the ends of a row, from each other; and on the distance of the flags from the station. Care should be taken not to make the arc too small.

During night, coloured lanterns are used, which are darkened towards the enemy.

The colour of the flag or lantern, or its number, indicates the number of the torpedo which has to be placed in connection with the battery.

It is necessary to mark out several points in each line of sight, in order to be able to replace a signal at any one point, in case it should be destroyed.

3. A third method is the one proposed by the Austrians for the observation of a vessel approaching their stationary torpedoes.

The method is similar to the one mentioned under No. 1 of this chapter.

The Austrian topscope exhibited at the Paris Exhibition of 1867 is very ingenious; its use, however, is limited.

(1.) It requires that but one row of torpedoes be placed.

(2.) That this row be a straight line, the alignment of which can be taken on shore.

CHAPTER XVII.

Effect of Torpedoes under Water.—How are they to be placed in reference—(a) to the Vessel intended to be destroyed; (b) to each other?

THE effect of the torpedo on the bottom or the sides of a vessel will depend on—

(1.) The distance of the vessel from the torpedo at the moment of the explosion; in other words, on the number of feet of water remaining between the vessel and the torpedo.

(2.) The quantity and quality of the powder, gun-cotton, or fulminate used for the charge.

(3.) The strength of the envelope containing the charge.

As arguments, which are based on actual facts, will have more force than mere theoretical speculations, we enter upon our theme by first giving the names of several vessels that, during the North American War, were either destroyed or damaged by the expolsion of torpedoes.

In Chapter VI., the sinking of the United States' Monitor *Tecumseh* (Bay of Mobile, August 5th, 1865) has already been mentioned. The destruction of the United States' steamer *Housatonic* (Charleston Harbour, February 18th, 1864); the sinking of the Confederate ram *Albemarle* (off Plymouth, October 30th, 1864), and other torpedo boat-attacks, with the circumstances attending them, will be found described in Chapter XIX. The following are extracts from official reports made by officers of the United States' navy on the loss of their vessels, or the injuries they sustained by the explosion of stationary torpedoes.

1.—*Loss of the United States' Iron-clad "Cairo."*

"UNITED STATES' GUN-BOAT *Signal*,
"Off Yazoo River, December 13th, 1862.

"SIR,— It becomes my painful duty to announce to you the total loss of the gun-boat *Cairo*, while under my command, from the explosion of two torpedoes under or near her, placed in the Yazoo River, some sixteen miles from its mouth.

* * * * * * *

"Arriving near the spot indicated, when the leading gun-boat, the *Marmora*, was partially hidden by a bend in the river, a heavy fire of musketry opened; the steamer commenced backing at the same time, leading me to suppose she was attacked from the shore. I hastened up to her support, when I found the firing was from the *Marmora*, at an object, a block of wood floating in the river.

"I ordered her to cease firing, and to lower a boat to examine. They either did not hear my order, or were loth to obey it; and, showing no signs of executing it, I lowered one of my own boats. They fished it up, and found it to be a portion of a torpedo which had exploded the day before.

"In the meanwhile, the head of the *Cairo* having got in towards the shore, I backed out to straighten up stream, and ordered the *Marmora* to go ahead slow. I had made but half-a-dozen revolutions of the wheel, and gone ahead perhaps half a length, the *Marmora* a little ahead, leading, when two sudden explosions in quick succession occurred, one close to my port quarter, the other apparently under my port bow; the latter so severe as to raise the guns under it some distance from the deck. She commenced to fill so rapidly, that in two or three minutes the water was over her forecastle. I shoved her immediately for the bank, but a few yards distant, got out a hawser to a tree, hoping to keep her from sliding off into deep water. The pumps, steam and hand, were immediately manned, and everything done that could be. Her whole frame was so completely shattered that I found immediately that nothing more could be effected than to move the sick and the arms. I ordered the *Queen of the West* alongside, and passed what articles I could get at into her, with a portion of the crew, the remainder taking to our boats. The *Cairo* sunk in about twelve minutes after the explosion, going totally out of sight, except the top of the chimneys, in six fathoms of water. I am happy to say, that though some half-a-dozen men were injured, no lives were lost.

* * * * * * *

"Though I found we were in the vicinity of torpedoes, there were no signs to show at the time that any were in my immediate neighbourhood, the *Marmora* having passed ahead of me.

"Very respectfully, your obedient servant,

"THOMAS O. SEDFRIDGE,
"Lieutenant-Commander.

"CAPTAIN HENRY WALKE, U.S.N.,
"Commanding Naval Forces off Yazoo River."

2.—*Loss of the United States' Steamer "Baron de Kalb."*

"U.S. MISSISSIPPI SQUADRON, FLAG-SHIP *Black Hawk*,
"Off Vicksburg, July 22nd, 1863.

"SIR,—I had the honour to inform you of the blowing up of the *Baron de Kalb* by a hidden torpedo, seventeen having been planted in the river, without wires attached to them. The water having risen two or three feet during the night, enabled all the vessels but the *De Kalb* to pass over them.

"I am not sure that we shall be able to raise the *De Kalb*, as she sunk in twenty feet of water, and we cannot yet ascertain the injuries; but every effort will be made.

* * * * * * *

"I have the honour to remain, very respectfully, your obedient servant,

"DAVID D. PORTER,
"Acting Rear-Admiral, Com. Miss. Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy."

3 & 4.—*Loss of the United States' Steamer "Otsego" (Lieutenant-Commander H. N. T. Arnold), and of the United States' Tug "Bazley," in Roanoke River, off Jamesville, December 9th*, 1864.

"UNITED STATES' STEAMER *Wyalusing*,
"Roanoke River, N.C., Dec. 11th, 1864.

"ADMIRAL,—I have the honour to make the following report of the operations of the naval part of the expedition to capture Rainbow Bluff, in obedience to your orders of the 1st of December.

* * * * * * *

"After steaming up the river, we arrived at a sharp bend just below Jamesville, where I came to anchor for the night, the army force having agreed to communicate with me at this town. After coming to anchor in the Wyalusing, I made signal for the other vessels to do also. In obedience to this order, the *Otsego* had stopped her engine, and was just about to let go her anchor, when a torpedo exploded under her on the port side, and shortly afterward another exploded under her forward pivot-gun, which was thrown over on the deck by the concussion; the two explosions injuring her so badly that she sank in a few moments, her spar-deck being about three feet under water. Fortunately, no one was killed on board the *Otsego*, and, with the exception of a few slight scratches, no one was injured. The *Otsego* had spars rigged out ahead of her, to which was fastened a net for the purpose of catching the torpedoes, and two were found in the net after she sunk. She must have stopped directly on top of a line of these infernal machines. The night passed without disturbance, and in the morning I determined to send the *Bazley* to Plymouth to find out what the army were doing, and to get rations from the *Shamrock* for the *Otsego's* crew. * * * *

* * * * * * * * * *

"I got the *Bazley* along the Wyalusing, and sent Acting Assistant-Paymaster Sands on board to take despatches to

Plymouth, and then sent the tug to the *Otsego* to get some men and an officer. When the *Bazley* had got within a few yards of the *Otsego*, another torpedo exploded under her, and she went down right alongside of the *Otsego*. By this explosion two men were killed, but none of the officers.

* * * * * * *

"These torpedoes are made on a new plan, with an air-chamber above the powder, on the same plan as that used by Lieutenant Cushing. They are very sure, and every one we have picked up was in good condition, two of them bursting as we were hauling them ashore, but hurting no one. * *

"When we advance any further, it will be necessary to have more vessels, otherwise we will be unable to patrol the river below us, and consequently the rebels will be able to lay more torpedoes, and blow us up on our return.

"Very respectfully, your obedient servant,

"W. H. Macomb,
"Commander, Com. Dist. Sounds, N.A. Squadron.

'Rear-Admiral D. D. Porter,
"Commanding North Atlantic Squadron."

5.—*Explosion of a Torpedo under the United States' Steamer "Jonquil."*

"United States' Steamer *Jonquil*,
"Charleston Harbour, S.C., June 4th, 1865.

"Sir,—In obedience to your order of the 5th of March, I proceeded up Ashley river, accompanied by two boats from the United States' steamer *Home*, to drag the river for torpedoes and other obstructions that might retard the progress of vessels. On arriving off the mouth of the river, I commenced dragging, and soon hooked on to something which the boats could not stir. I then put over the quarters of the *Jonquil* a heavy 3-inch hemp-line, to which was attached a large 50-pound grapnel, and started up the river. I soon hooked on the obstruction, but was unable to stir it. I then took the line forward, and took it to the windlass, and hove on it. It came slowly, but, owing to the great weight, it broke, and on portions of it being brought up, proved to be a framework of pine logs, spiked together with heavy iron spikes. Its form, from what I saw of it, was square, and about twenty to thirty feet square, having its centre filled up with heavy planks, and bolted to the logs. On each end of the frame was placed a torpedo, made of iron and conical, having on their bottom four flanges for bolts and nuts, which were riveted to the logs. The torpedoes were capable of holding from thirty to forty pounds of powder each, having a percussion-fuze, to be ignited by sulphuric acid in a glass vial. This framework was sunk with stones, and at low water was about two feet below the surface, and about eight feet at high water. These obstructions were placed in the channel, and were very dangerous, and should a vessel attempt to enter the river she must have been destroyed. I continued dragging for the rest of this work, and succeeded in pulling it to pieces.

"On the following day, the 6th, I proceeded up to the same place, and commenced dragging again in the same manner. I had proceeded but a very short distance, when I hooked on to another frame. It was situated about one hundred yards further up the river, and a little to the right of the last. I proceeded, as before, to heave them up, which I succeeded in doing in this manner: I secured three of the torpedoes in dragging. The logs became separated. I hooked on to the log which had the fourth one on, but the log came up with the end not having the torpedo on. I hoisted it to the bows of the steamer, and started for shore. On shoaling the water, the torpedo being down, struck the bottom, and exploded directly under and about amidships of the steamer. Its force was so great as to raise the boilers five inches from their bed, and knocked nine men overboard, and completely flooded the vessel. One of the men was standing on the berth-deck at the time of the explosion, and its force was so great as to throw him up against the deck, and split his head open, and the engineer on watch had his back severely hurt by the concussion.

"At the time of the explosion I was in about ten feet of water, and had it been shoaler the vessel would have been entirely destroyed. Every movable thing was thrown down, doors shattered, windows all broke, and all light work started. The howitzer forward was upset, and three beams were badly sprung. The steam-gauge and condense were broken, and nearly all the lighter machinery was disabled. The hull of the vessel, however, I found on examination was not materially damaged.

"On the following day I started up the river again, and commenced dragging. I found another set similar to the others, and situated directly opposite the other. I dragged until I had secured all the torpedoes, and torn the logs asunder, thus effectually destroying that set of obstructions. From the positions they were placed in, the three frames formed a triangle: thus had a vessel escaped the first set, she would very likely have fouled one of the others. * * *

* * * * * * * * *

"The number of torpedoes I took up on these obstructions was twelve, all iron and alike, fitted with vials of sulphuric acid.

"Very respectfully,

"CHARLES H. HANSON.

"Acting-Ensign Commanding.

"REAR-ADMIRAL JOHN A. DAHLGREN,
"Commanding S.A.B. Squadron."

6.—*Loss of the United States' Monitor "Patapsco."*

(*a*.) EXTRACT FROM THE REPORT OF REAR-ADMIRAL J. A. DAHLGREN.

"FLAG-SHIP *Harvest Moon*,
"Charleston Roads, Jan. 16th, 1865.

"* * * * When near Sumter, Lieutenant-Commander Quackenbush steamed down once more, and for the last time. While approaching the Lehigh buoy there was a shock—a sound of explosion—a cloud of smoke on the port side, and in less than half-a-minute the *Patapsco's* deck was under the surface.

"Lieutenant-Commander Quackenbush and his first lieutenant were standing on the top of the turret looking to the course of the vessel, for she had grounded already on the shoal near the Lehigh buoy, when standing down the first time. They saw and heard only what is stated above.

"The captain gave the order to start the pumps and lower the boats, but scarcely a whole minute was allowed for the least effort.

"Five officers and thirty-eight men were saved; sixty-two officers and men are missing. The survivors were those who happened to be on deck, and two men from the windlass-room, three from the berth-deck, one from the turret-chamber, and nearly all those who were in the fire-room.

"From such accounts as I can gather in so short a time as has elapsed, it would seem that the explosion occurred on the port side under the ward-room, blowing it up so as to drive up the table and three officers who were sitting about it. The spar-deck was not blown through, but the look-out on the port side and some ten feet from the edge of the deck was thrown up suddenly, and fell back with such force as to be nearly senseless. His rifle exploded, and he was aware that the ball passed near him.

"A man in the windlass-room saw a flash and heard a sound like that of a shell near him. The lamp was extinguished; he heard the water coming in, and escaped up the hatch on deck.

"It appears also that there was no disrupture of the vessel at the berth-deck nor further aft; that no water came in there, save at the hatches, as the *Patapsco* settled in the sea; and that her bow went down first, throwing the stern high up for an instant, so that a man standing there had to grasp at something to keep upright.

* * * * * * *

(*b.*) REPORT OF LIEUTENANT WILLIAM T. SAMPSON.

"UNITED STATES' IRON-CLAD *Catskill*,
"Charleston Roads, S.C., Jan. 16th, 1865.

"SIR,—Upon me, as one of the fortunate, devolves the sad duty of reporting to you the destruction, by a large torpedo, of the Monitor *Patapsco* while on picket duty. * *

* * * * * * * * *

"We again steamed down the channel, and were going four bells, when the vessel struck the torpedo, and sunk in about fifteen seconds. The last cast of the lead, given a moment before she struck, was five fathoms. We were then about 300 yards to the north of Lehigh buoy. The torpedo struck the vessel on the port side, just abreast the belts, and appeared to raise the deck, through which the smoke issued. My first impression on hearing the report was that a shot had struck the overhang just below the water, but the column of smoke and water which immediately shot upward convinced me of the real nature of the explosion.

"The order to start the pumps was immediately given by you down through the turret. So impracticable did the execution of the order appear the next instant, that I did not repeat it. You immediately afterwards gave the order to man the boats. Although these orders were given in rapid succession, only the officer of the deck, who stepped from the turret into the boat, and one man, had time to obey the last order before the boat was afloat at the davits.

"Owing to the wise precaution of having the picket boats near at hand, all those who were on deck at the time were saved. None escaped from below except the engineer and firemen on watch, and one man, who passed from the berth-deck through into the fire-room and up the hatch. * *

* * * * * * * * *

"Very respectfully,

"William T. Sampson,

"Lieutenant.

"Lieutenant Commanding S. P. Quackenbush."

7.—*Sinking of United States' Steamer "Harvest Moon."*

Report of Rear-Admiral J. A. Dahlgren.

"Flag-steamer *Nipsic*,
"Georgetown Roads, March 1st, 1865.

"Sir,—My last despatches, Nos. 82 and 83, had been closed, and not hearing anything of General Sherman at this place, I was on my way to Charleston, but was interrupted for the time by the loss of my flag-ship, which was sunk by the explosion of a torpedo. This took place at 7.45 a.m. to-day, and the best information I now have is from my own personal observation. What others may have noticed will be elicited by the court of inquiry which I shall order.

"The *Harvest Moon* had been lying near Georgetown until yesterday afternoon, when I dropped down to Battery White, two or three miles below, intending to look at the work and leave the next day. Accordingly, this morning early the *Harvest Moon* weighed anchor and steamed down the bay. She had not proceeded far when the explosion took place.

"It was nearly 8 o'clock, and I was waiting breakfast in the cabin, when instantly a loud noise and shock occurred, and the bulkhead separating the cabin from the ward-room was shattered and driven in towards me, and a variety of articles lying about me were dispersed in different directions. My first impression was that the boiler had burst, as a report had been made by the engineer the evening before that it needed repair badly. The smell of gunpowder quickly followed, and gave the idea that the magazine had exploded. There was naturally some little confusion, for it was evident that the vessel was sinking, and she was not long in reaching the bottom. As the whole incident was the work of a moment, very little more can be said than just related. But one life was lost, owing to the singularly fortunate fact that the action of the torpedo occurred in the open space between the gangways and between the ladder to the upper deck and the ward-room, which is an open passage-way occupied by no one, and where few linger save for a few moments. Had it occurred farther aft or forward the consequences would have been fatal to many. A large breach is said to have been made in the deck just between the main hatch and the wardroom bulkhead. It had been reported to me that the channel had been swept; but so much has been said in ridicule of torpedoes, that very few precautions are deemed necessary, and if resorted to, are probably taken with less care than if due weight were attached to the existence of these mischievous things. * * * * *

"I have the honour to be, &c.,

"J. A. DAHLGREN,
"Rear-Admiral, Commanding S.A.B. Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy."

8.—*Destruction of United States' Steamer "Commodore Jones."*

"FLAG-SHIP *Curl's Neck*, May 7th, 1864.

"Yesterday, about 12 M., a large torpedo, which dragging had failed to discover, was exploded under the *Commodore Jones*, near Four-Mile Creek, and utterly destroyed the vessel, and about half the crew were killed and wounded.

● ● ● ● ● ● ●

"S. P. LEE,
"Acting Rear-Admiral.

"HON. GIDEON WELLES,
"Secretary of the Navy."

9.—"*Maple Leaf*" *blown up by a Torpedo.*

"UNITED STATES' STEAM-SLOOP *Pawnee*,
"Off Mayport Mills, Florida, April 1st, 1864.

"COMMODORE,—I have just received information that the transport *Maple Leaf* was blown up by a torpedo when she was off Mandarin, distant fifteen miles above Jacksonville.

"The *Maple Leaf* was on her way down the St. John's, and my informant states that her bow was blown off.

● ● ● ● ● ● ●

"GEO. B. BALCH,
"Commander and Senior Officer.

"COMMODORE S. C. ROWAN, U.S.N.,
"Commanding S.A.B. Squadron off Charleston."

LOSS OF UNITED STATES' VESSELS CAUSED BY TORPEDOES IN THE BAY OF MOBILE FROM MARCH 28TH TO APRIL 18TH, 1865.

10 & 11.—*Loss of the United States' Monitors "Milwaukie" and "Osage."*

(*a.*) REPORT OF ACTING REAR-ADMIRAL H. K. THATCHER.

"WEST GULF SQUADRON, U.S. FLAG-SHIP *Stockdale*,
"Off Blakely River, Mobile Bay, April 3rd, 1865.

"SIR,—I have the honour to inform the Department that the river Monitors *Milwaukie*, Lieutenant-Commander J. H. Gillis, and *Osage*, Lieutenant-Commander W. M. Gamble, have been sunk by torpedoes at the entrance of Blakely River, the former on the 28th ultimo, and the latter on the 29th, as they were advancing and firing upon the rebel forts commanding the entrance.

"Before sending the Monitors over the shallow bar into the river, I had it thoroughly dragged for torpedoes, and many were removed. We continued to drag until no more could be found, and it was believed that we could successfully advance upon the forts, but the result thus proved the impossibility of doing so without endangering the loss of all our light-draught vessels. These hidden instruments of destruction abound everywhere in these shallow waters. The tin-clad steamer *Rudloph* was also sunk by a torpedo on the 1st instant, whilst towing a scow to the sunken vessels with implements for the purpose of raising the *Milwaukie.* These vessels will probably be lost, though we shall be able to save the guns and many valuable property from them. On the sinking of the *Milwaukie*, I despatched a vessel immediately to Pensacola for a steam-pump and diver's apparatus, with the men to work them. * *

"The ground around the forts, as well as the roads, are planted with torpedoes, which occasionally explode, destroying men and animals. * * * * * *

* * * * * * * * *

"Very respectfully, &c.,

"H. K. THATCHER,
"Acting Rear-Admiral, Com. W.G. Squadron.

"HON. GIDEON WELLES,
"Secretary of the Navy."

10.—*Sinking of U.S. Monitor "Milwaukie."*

(*b.*) REPORT OF LIEUTENANT-COMMANDER JAMES H. GILLIS.

"U.S. STEAMER *Genesee*,
"Mobile Bay, March 30th, 1865.

"SIR,—I take the earliest opportunity to make a report of the sinking of the U.S. Monitor *Milwaukie*, under my command, on the afternoon of the 28th instant. * * *

"I had returned within about 200 yards of the United States' iron-clad *Kickapoo*, then lying at anchor, and supposed the danger from torpedoes was past, as I was where our boats had been sweeping, and also exactly in the same place where the United States' iron-clad *Winnebago* had turned not ten minutes before, when I felt a shock, and saw at once that a torpedo had exploded on the port side of the vessel abaft the after-turret, and, as near as I could determine at the time, about forty feet from the stern. My first object, after realizing the impossibility of saving the vessel, was to save the crew, and I am happy to be able to state that this was done without the loss of a single person.

"There was naturally some confusion at first, the hatches being closed, and but three being provided with levers to open them with from below, and those who were not on deck being dependent on those who were for other means of egress; but a single command served to restore order, and all came on deck in a quiet, orderly manner. The stern of the vessel sank in about three minutes, as near as I can judge, but the forward compartments did not fill for nearly an hour afterwards, giving the crew an opportunity of saving most of their effects. * *

"I have the honour, &c.,

"J. H. GILLIS,
"Lieutenant-Commander, U.S.N.

"ACTING REAR-ADMIRAL H. K. THATCHER,
"Commanding W.G. Squadron."

11.—*Sinking of the U.S. Iron-clad "Osage."*

(c.) REPORT OF LIEUTENANT COMMANDING WM. M. GAMBLE.

"Mobile Bay, March 29th, 1865.

"SIR,—I have the honour to submit the following report of the circumstances attending the loss of the United States' iron-clad *Osage*, under my command.

* * * * * * *

"Almost immediately after stopping, I ordered three bells rung to back, and moved forward from the pilot-house, inte ing to step on the turret to order the anchor let go, but not taken more than three steps from my position at forward door of the pilot-house, when a torpedo explo under the bow, and the vessel immediately commenced sinki I ordered the executive officer, Acting Master G. W. Garris to take as many men below as necessary, and search wounded or killed, and to send all the rest of the crew the hurricane-deck, except two hands at each boat to h them alongside.

“My orders were executed promptly, and although ship filled and settled rapidly, two killed and the five wound below were passed up. Three others were wounded on de The wounded were conveyed to the nearest ship for medi attendance. It was impossible to save but few articles belon ing to the ship, as she almost immediately filled. As position to which I moved the *Osage* had been thorough dragged by boats, I am of the opinion that the torpedo which she was sunk was submerged and drifting. * *

“I am, sir, &c.,

“Wm. M. Gamble,
“Lieutenant-Commander, U.S

“Acting Rear-Admiral H. K. Thatcher,
“Commanding W.G. Squadron.”

12.—*Sinking of the U.S. Tin-clad “Rodolph.”*

“United States' Steamer *Rodolph*
“Blakely River, April 2nd, 1865.

“Sir,—It becomes my duty to make you the followi report relative to the sinking of this vessel yesterday by t explosion of a torpedo. * * * *
When directly between the *Chickasaw* and the *Winnebago* e ploded a torpedo under my starboard bow, from the effect which the ship rapidly sank in 12 feet of water. I arrived board at 3.20 p.m., and found the wounded properly cared f by the promptness with which boats were sent to our assistan

from vessels in the vicinity. The torpedo exploded under our starboard bow, about 30 feet abaft a line drawn at right angles with our stem, coming through the gun-deck at the break of the platform on which our Parrot guns were mounted; and from the effects of the explosion that can be seen, I should judge there was a hole through her bow at least 10 feet in diameter. She now lies with her gun-deck submerged about 5½ feet at low water. I regret to report a loss of one killed, eleven wounded, and three missing. * * * *

"Very respectfully, &c.,

"N. M. Dyer,
"Acting-Master Commanding.

"Acting Rear-Admiral H. K. Thatcher,
"Commanding W.G. Squadron."

13.—*Loss of the U. S. Gun-boat "Sciota" by a Torpedo.*

"United States' Steamer *Sciota*,
"Off Mobile, Ala., April 14th, 1865.

"Admiral,—I have the painful duty to respectfully report the sinking of the United States' gun-boat *Sciota*, under my command, by a rebel torpedo, and the loss of four men and wounding of six others. In obedience to orders from Fleet-Captain E. Simpson, I had finished coaling the barge from the brig *American Union*, and had delivered to the *Itasca*, *Sebago*, and *Genesee* the working parties belonging to the aforesaid vessels, and was proceeding towards the eastern shore on an east-south-east course, for the purpose of delivering ten men of the working party to the United States' steamer *Elk*, when I ran against a torpedo which was below the surface of the water, exploding it, causing the vessel to sink immediately, nearly decks to the water. The explosion was terrible, breaking the beams of the spar-deck, tearing open the water-ways, ripping off starboard fore-channels and breaking fore-topmast. I have examined the decks and water-ways immediately over the place where the explosion took place, and, in my opinion, the damage is not so extensive as to prevent raising her. I have also questioned those of the crew who were on the berth-deck at the time of the explosion, and their evidence in regard to the effect upon the berth-deck by the explosion leads me to think that it struck the vessel below the line of the berth-deck, and under and abreast of the fore-rigging at the first bow cant or round of the bow. * * * * * *

"I have the honour, &c.,

"J. W. MAGUIRE, U.S.N.,
"Volunteer Lieut. Commanding.

"ACTING REAR-ADMIRAL H. K. THATCHER,
"Commanding W.G. Squadron."

14.—*Loss of the United States' Tug "Ida."*

"Mobile Bay, April 15th, 1865.

"SIR,— * * * * * *

After reaching the *Cincinnati* and reporting, I was ordered to proceed to the United States' steamer *Genesee*, lying about two miles below the obstructions. When about two-thirds of the way down, the steamer struck a torpedo on her starboard side, crushing in her timbers, bursting her boilers, and tearing up her decks: she filled in a few moments in ten feet of water, where she now lies directly in mid-channel. Every possible assistance was rendered by the vessels in sight to save life and property. The guns have been taken off, and a portion of the engine has been removed.

"Very respectfully, &c.

"F. ELLMS,
"Acting-Ensign Commanding.

"ACTING REAR-ADMIRAL H. K. THATCHER."

15.—*Loss of the Launch of the U.S. Iron-clad "Cincinnati."*

"U.S. IRON-CLAD *Cincinnati*.

"SIR,—I deeply regret to have to report the blowing-up of the launch of this vessel by a torpedo yesterday afternoon.

* * * * * * *

The launch had caught a torpedo, and had weighed it to within about two feet of the surface of the water, when the mooring parted, and the strain on the drag-rope brought the torpedo against the stern of the boat, exploding it. * * *

"I am, &c.,

"GEORGE BROWN.

"ACTING REAR-ADMIRAL H. K. THATCHER."

16.—*Loss of the United States' Steamer "Althea."*

"HOSPITAL ROOMS, MOBILE, April 19th, 1865.

"SIR,—I have the honour to report the loss of the U.S. steamer *Althea.* * * * * * *
After this was done, I attempted to return to the *Octorara*, but the vessel ran afoul of a torpedo, which exploded near the after-part of the pilot-house, a little to the starboard: the vessel sunk immediately in 10 or 12 feet of water, and I regret to state that two men were killed, two others badly wounded, and that I am badly injured in the left leg and foot. * *

"I am, sir, very respectfully,

"F. A. G. BACON,

"Acting Ensign, late Commanding
U.S. Steamer *Althea.*

"ACTING REAR-ADMIRAL H. K. THATCHER,
"Commanding W.G. Squadron."

None of the torpedoes contained a heavier charge than sixty pounds of cannon-powder; those used in the Bay of Mobile had a charge even smaller, namely, from thirty-five pounds to fifty pounds, and yet their effect was certainly, as will be granted from the above statements, most destructive.

All these torpedoes (the one that sunk the *Cairo*, on Yazoo River, and the one by which the *Commodore Jones* was destroyed excepted) were self-exploding contact-torpedoes; therefore the fact has been established that charges of sixty pounds of powder, if properly enclosed, are sufficient to destroy any vessel the sides or bottom of which the torpedo touches.

The effect of torpedoes under water has been, furthermore, investigated by practical experiments made by order of various governments.

1.—Results of Experiments made in the United States.

1. A raft (see accompanying sketch, figs. 1 and 2) was formed of timbers, 12 inches by 12 inches, loosely framed together. The structure was an open framework, from which was suspended in the centre a cast-iron torpedo, which was $\frac{1}{2}$-inch thick, and contained one hundred and fifty pounds of cannon powder. This torpedo was placed 15 feet below the surface of the water. At the distance of every four feet a round iron rod, 30 feet long and $\frac{1}{4}$-inch in diameter, was suspended from the raft; the latter, therefore, being 80 feet square, carried about four hundred of these rods. Each rod had a line attached to it, which was fastened at its other end to a small wooden block placed loosely on the raft. These blocks were numbered according to the distance, in feet and inches, of the rod with which they were connected from the torpedo.

FIG. 1.

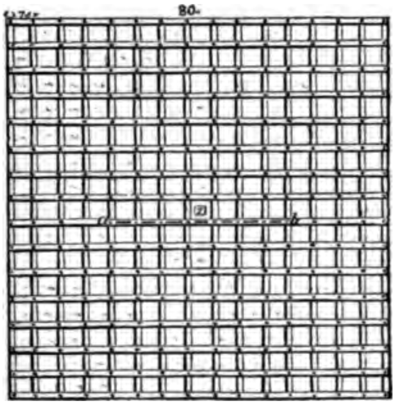
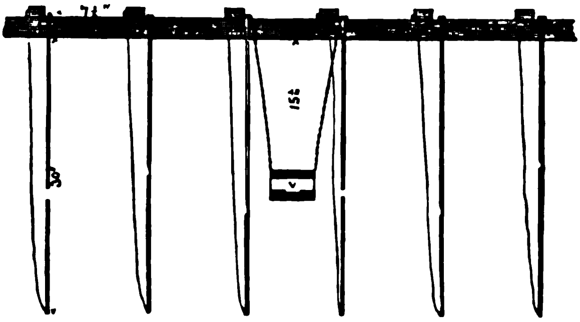


FIG. 2.



The torpedo was fired with electricity. The middle part of the raft was entirely destroyed, and even the outer edge was more or less torn asunder; iron rods within a circle of 27¼ feet radius near the point where the explosion had taken place were broken in two and very much twisted. A great regularity was observed in the decrease of the effect of the explosion on the rods from the periphery of the above circle.

This experiment proved that one hundred and fifty pounds of powder, enclosed in a cast-iron torpedo ¾-inch thick, and sunk to a depth of 15 feet, has no effect beyond a distance of 27¼ feet.

2. The same experiment was made with a torpedo again containing one hundred and fifty pounds of powder, which were enclosed in a gutta-percha sack covered by a tin box.

The effect of the explosion on the iron-rods was very irregular; it ceased, however, altogether at distances varying from 10 feet to 17 feet.

3. The experiment was repeated with an oaken barrel containing the same charge. The staves were 1-inch thick, and were held together by iron-hoops 2‴ thick.

The effect was nearly the same as that reached by the explosion of the cast-iron case, or in a strong oaken barrel held together by iron-hoops, as entirely sufficient to tear open the bottom or the sides of any vessel, provided the explosion takes place immediately under the vessel or at its sides. For this reason no further experiments of this class with lesser charges have been made, neither were the same extended to torpedoes charged with one thousand pounds of powder and over.

4. Other experiments had the object to ascertain the depths of water in which charges of different weight would produce the greatest effect.

It was found that torpedoes loaded with from fifty to eighty pounds of powder should not be placed at a less depth than 7 feet; in a depth of 12 feet their effect appears to be greatest.

Torpedoes containing one hundred and fifty pounds of powder should be sunk to a depth of 15 feet.

Torpedoes attached to the spars of torpedo-boats should be lowered to depths corresponding to these data.

5. Still further experiments were made with the view of ascertaining what effect the explosion of torpedoes would produce on the sides and bottom of vessels, between which and the torpedo a cushion of water had been left.

For these experiments wrecks and old vessels were used. The charge of the torpedo, in every experiment, consisted of cannon-powder.

(a.) *Effect on the Sides and Floor-heads.*

1. A torpedo containing forty-five pounds of powder, firmly enclosed, was placed immediately against the side of the vessel. The torpedo was sunk to a depth of 12 feet.

Effect: A large hole torn in the side of the vessel.

2. The same torpedo sunk to the same depth had but little effect at the distance of 1′ from the side of the vessel.

3. A strongly made torpedo, containing a charge of one hundred pounds, produced at a distance of one foot from the vessel the same effect as torpedo No. 1.

4. A torpedo containing a charge of four hundred pounds produced, at a depth of 12 feet, and at a distance of 2 feet from the vessel, no effect on the side of the vessel. The charge was enclosed in a cylinder of cast-iron ½-inch thick.

5. The charge having been increased to five hundred pounds, the explosion of the torpedo, that had been sunk to the depth of 18 feet, stove in, at a distance of 2 feet from the vessel, a large part of its side.

6. A thousand pounds of powder enclosed in a strong wine-cask, the staves of which were 1½″ thick, and bound by iron hoops, produced, at a depth of 18 feet, and a distance of 4 feet from the vessel, hardly any effect whatever. It is to be remarked here that it is almost impossible to make envelopes in which charges of the weight of five hundred pounds or a thousand pounds of powder are enclosed strong enough to pre-

vent parts of the large charge from being blown unburnt into the water. On the other hand, it appears quite an easy matter to enclose lesser charges in envelopes of sufficient strength to give the powder time to fully ignite ere the envelope gives way to the gas produced by the combustion of the whole charge.

(*b.*) *Effect on the Bottom of a Vessel.*

1. A torpedo containing forty-five pounds of powder, and being placed immediately under the bottom of a vessel, opened a hole in the bottom large enough to cause the vessel to fill with water, and to settle down within a few moments.

2. The same result was obtained with a torpedo containing fifty pounds of powder, but fired at a distance of 1 foot below the bottom of the vessel.

3. The same torpedo fired at a distance of 2 feet below the bottom produced no effect.

4. One hundred and fifty pounds of powder, enclosed in an oaken barrel, and fired at a distance of 2 feet below the bottom of the vessel, caused the almost instantaneous sinking of the ship.

5. At a distance of 4 feet below the bottom of the vessel, four hundred pounds of powder produced a doubtful effect.

2.—RESULT OF AN EXPERIMENT BY BARON VON EBNER IN AUSTRIA.

Two by contact self-igniting torpedoes (see Austrian Torpedo, Chapter XV.) were charged with 3 cwt. of gunpowder each. They were placed 12 feet below the surface of the water, and at a distance of 30 feet from each other. The anchoring of torpedo No. 1 was effected in a manner that admitted of the torpedo being drawn against the side of an old coasting-vessel, which was firmly anchored near the spot where the torpedo had been sunk. The torpedo was manœuvred from a pontoon by means of a line. The apparatus for testing torpedo No. 2 was the one previously described. The envelope of the torpedoes was made of boiler-iron $5^{\text{m.m.}}$ thick.

Torpedo No. 1 was rapidly drawn against the side of the vessel; the explosion was effected in the manner described in Chapter XV., and the vessel was entirely destroyed, whilst torpedo No. 2 had not been injured at all by the explosion.

From this experiment it may be seen that 3 cwt. of gunpowder, enclosed in an envelope of as little strength as boiler-iron, and fired at a depth of 12 feet below the surface of the water, produces no effect at a distance of 30 feet in a horizontal direction.

Austrian engineers speak of enclosing charges of four hundred pounds of gun-cotton in cylinders made of boiler-iron $5^{\text{m.m.}}$ thick, which they intend to place only 30 feet apart, without anticipating that by the explosion of one torpedo the cables leading to its adjacent torpedoes could in the least be injured. These torpedoes have a height of 1·05 mètres, and a diameter of 1·10 mètres.

RÉSUMÉ.

From the foregoing statements the following deductions may readily be made:—

1. Self-exploding contact-torpedoes require a charge of from forty-five pounds to sixty pounds of powder only, provided the charge be enclosed in a strong envelope—for instance, in a cast-iron case ½-inch thick, or in an oaken barrel made of staves 1 inch thick, and bound by iron hoops 0·25 inch thick.

2. The effect of the torpedo on the bottom of a vessel appears to be greater than on its side and floor-heads.

3. The combustion of gunpowder is so slow, that it is not possible to give the case, in which very heavy charges are enclosed, sufficient strength to prevent the case from giving way ere the whole charge has been fully ignited. The com-

bustion of gun-cotton being fully as rapid as that of gunpowder, and the strength of gun-cotton being to that of gunpowder as 2½ : 1, it will appear that, for very large charges, gun-cotton would be more suitable than gunpowder. On the other hand, the greater bulk of gun-cotton will have to be considered.

3. Torpedoes exploding not immediately in contact with the bottom or side of a vessel seem to lose in effect in proportion to the cube of the distance from it.

4. Therefore, self-exploding contact-torpedoes promise a better effect than torpedoes, the firing of which is effected from on shore.

5. The effect of torpedoes placed close to, or on, the bottom of the channel, seems to spread more in a horizontal than in a vertical direction.

6. When circumstances require that torpedoes should be sunk to the bottom of a channel, or to a depth that brings the torpedo within only a few feet over the bottom, the charge should always be enclosed in a strong cast-iron case, or in a strongly-made cask.

7. In such a case it will be necessary to place the torpedoes at least 30 feet apart. For self-exploding contact-torpedoes, a distance of 25 feet would, under all circumstances, appear the most suitable.

8. Torpedoes are to be placed in several rows, and *en échelon*.

9. Self-exploding contact-torpedoes (those fired by electricity excepted) cannot be used for the defence of a gap in the line of obstructions, as long as the necessity or possibility exists for vessels of the national fleet to pass in and out.

10. When the charge is enclosed in a cast-iron case, the case should have a thickness of at least ¾-inch. When an oaken barrel is used, its staves should be 1 inch thick, and be bound by ¾-inch iron hoops.

11. The effect of charges enclosed in weak envelopes is not only very irregular, but, moreover, little destructive.

12. Thin envelopes render it difficult to introduce the exploding apparatus in a way by which the permanent exclusion of water from the charge is effected.

Nitro-glycerine has been successfully used for charges of mines, but whether its dangerous properties would admit of its being made use of for charges of torpedoes also, is at least very doubtful.*

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* See 'Journal of the Royal United Service Institution:' abstract of a lecture on "Gun-cotton and other Explosive Agents," delivered by F. A. Abel, Esq., F.R.S., on May 25, 1866. (Vol. x., p. 417.)

CHAPTER XVIII.

(a.) Laying of Torpedoes.—(b.) Method of regulating the Position of Torpedoes according to tide-changes in the water.—(c.) Torpedoes alone no sufficient obstruction.—(d.) Torpedoes to be placed in several rows, and en échelon.—(e.) Where advantageously employed.—(f.) Anchoring of Torpedoes.—(g.) Torpedoes should not be discoverable on the surface of the water.—(h.) Influence of salt water on the Torpedoes—(i.) Advantages and defects.—(k.) Comparative cost-price of the several classes.

The laying of torpedoes is an operation that, like all others necessitating the handling of large quantities of gunpowder or gun-cotton, will require some care on the part of the working parties detailed for this service.

With self-exploding contact-torpedoes especially, the danger of a premature explosion can be avoided only by paying the strictest attention to the safety-pins or safety-guards, and only removing them after the torpedo has been placed in position. In this regard, torpedoes which are to be fired by electricity deserve preference over all others. It is, however, a remarkable fact that during the whole course of the American war, but very few accidents happened to men of the torpedo service, and these could always be readily traced to carelessness or gross negligence.[*]

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[*] On August 6th, 1864 (the day after Admiral Farragut had forced his entrance into the Bay of Mobile), twelve torpedoes were despatched in a four-mule waggon from Mobile to the mouth of Dog River. The torpedoes were to be exploded by friction, but were, of course, provided with safety-guards. An officer, Lieutenant Harnett, was sent in charge with two negroes, one of whom drove and the other rode in the waggon. The latter amused himself with unscrewing the safety-guards of one of the torpedoes to satisfy his curiosity as to the construction of the machine. Suddenly the lieutenant, who was

In taking up torpedoes, several accidents have happened to sailors of the Federal fleet; but even these, according to the statements of the officers commanding the ships to which these sailors belonged, could have been avoided by carefulness. It is unnecessary to go into any further description of the mode of placing torpedoes attached to the spars of rafts, or fastened to piles or sunken frames. (Plate IX.)

The small amount of powder contained in the torpedoes described in Chapters XIII. and XIV. makes it comparatively easy to place them. The case, however, is different with the Austrian torpedo, and in general with all those which require very heavy charges, whether they float or lie on the bottom of the channel.

The following is the Austrian method, which is not without ingenuity:—

Each torpedo has an anchor of seven times its weight. To the swivel of the latter is attached a wire-cable or chain of a length which is determined by the depth of the channel, and the depth to which the torpedo is to be sunk. (For example, the channel being 60 feet deep, and the depth at which it is intended to keep the torpedo below the surface being 15 feet, the anchor-cable must be 45 feet.) To the upper end of this chain or cable is attached a small iron-roller (*r*). On this roller moves a second chain (*a*—*b*), whose two ends are temporarily attached to a buoy, and thus held near the surface of the water. On one section of this chain slides a slider (*s*), with a catch-arrangement (*c c*) that permits the chain to move towards (*b*) but not towards (*a*.)

The torpedo is now brought to the spot at which it is

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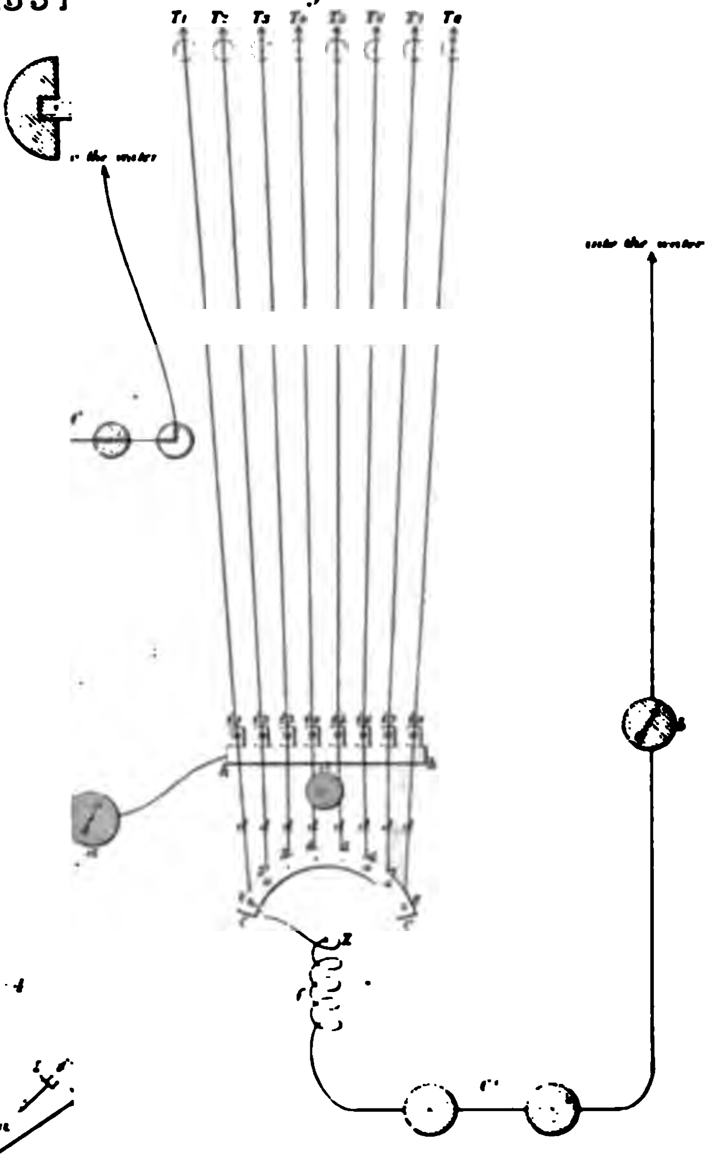
riding a few steps in advance, heard several explosions in rapid succession, and found himself off his horse and in a briar-hedge that lines the shell-road at that spot. On looking up he found the waggon blown to atoms, three mules lying dead in the road, the fourth one and his horse running wildly, the negro driver dead by the mules, and the author of the mischief a dozen steps off on the beach mortally wounded. The staves and hoops of the torpedoes had been thrown in every direction. The lieutenant, scratched and bleeding, walked back to the city and made his report.

AUST

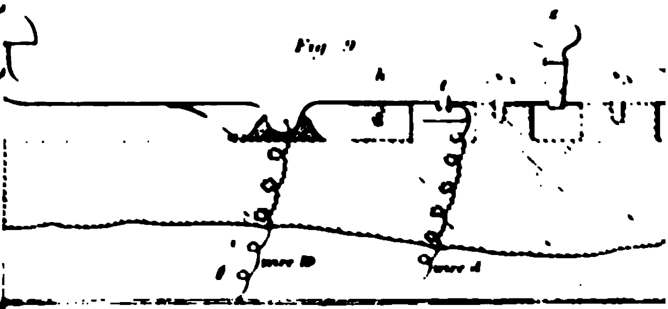
Fig: 8.



b

Fig. 4

Fig. 9



intended to be sunk, and by means of a crane let into the water to the depth at which it floats. To the bottom of the torpedo is attached a crow-foot, formed of three chains; with the end (*a*) of the sliding-chain (*a* - *b*) is connected by means of a screw-ring.

This being effected, the end (*b*) of the sliding-chain is drawn in until the torpedo has reached the required depth, at which it is then maintained by the sliding-catch (*s*). The length of the cable which has been hauled in is now either detached or simply dropped into the water.

It is to be remarked here that the insulated wire is sunk at the same time with the anchor by first drawing its end through the swivel of the anchor, and then attaching it to the buoy.

The introduction of the wire has to be effected before the sinking of the torpedo.

At intervals of from six feet to eight feet the chain should be provided with swivels.

(*b.*) *Method of regulating the Position of Torpedoes according to Tide-changes in the water.*

In localities where the difference in the height of the water at ebb and flood is not very considerable (as, for instance, in the Gulf of Mexico, the Baltic, &c.), it will be sufficient to suit the length of the anchor-cable to the depth at which it is desired that the torpedo should float below the surface at the average height of the water. A difference of from 1½ feet to 3 feet between ebb and flood will not materially affect the effect of torpedoes placed at a depth of not over 6 feet below the surface at the average depth of water in the channel. Even light-draught vessels will be very likely to run foul of a torpedo floating at that depth. But the case is very different when the difference between ebb and flood is as much as 10, 11, and more feet, as, for instance, on the shores of the German Ocean. A torpedo floating at ebb 7 feet below the surface of the water will, in this case, lie at flood 17, 18, and more feet below the surface, and therefore be rendered almost useless against light-draught vessels.

Further, as the most destructive effect of the torpedo cannot be secured by placing the charge too close to the surface, where the torpedo could be also very easily discovered, it will be necessary to arrange some contrivance by means of which torpedoes can be made to rise and fall with flood and ebb. During the North American war, the want of a regulating apparatus of this class was not felt, on account of the small difference in the height of the water at ebb and flood along the shores of the Southern States.

Not knowing of any plan previously suggested, we propose the following:—

The torpedo (*T*) has attached to it the roller (*r*), on which moves the anchor-cable (*a*—*b*). The end (*a*) of the cable is fastened to the anchor, the end (*b*) is attached to a buoy (*B*). This buoy has two staples (*s* and *s*) through which the anchor-cable passes; (*h*) is a hose or pipe, by means of which the buoy may be filled with water or pumped empty. The end (*e*) of this hose or pipe is kept floating near the surface by a small buoy (*f*). This end is generally closed.

If it is desired to lower the torpedo (as in the case of ebb), the buoy (*B*) is filled with water, and sinking by its weight causes the torpedo to follow (see fig. 1).

Is it desired to raise the torpedo again nearer to the surface of the water (as in the case of flood), the buoy (*B*) is pumped empty; it rises, and the increased length of the section of chain between the torpedo and the anchor permits the former to rise to its first position (fig. 2).

Notwithstanding the several objections which we are the first to raise to this plan, it being too complicated and requiring very close attention, we have ventured to propose it, in the hope of attracting the attention of some ingenious mind to a subject which is of much importance whenever torpedoes are

Fig

Fig 4

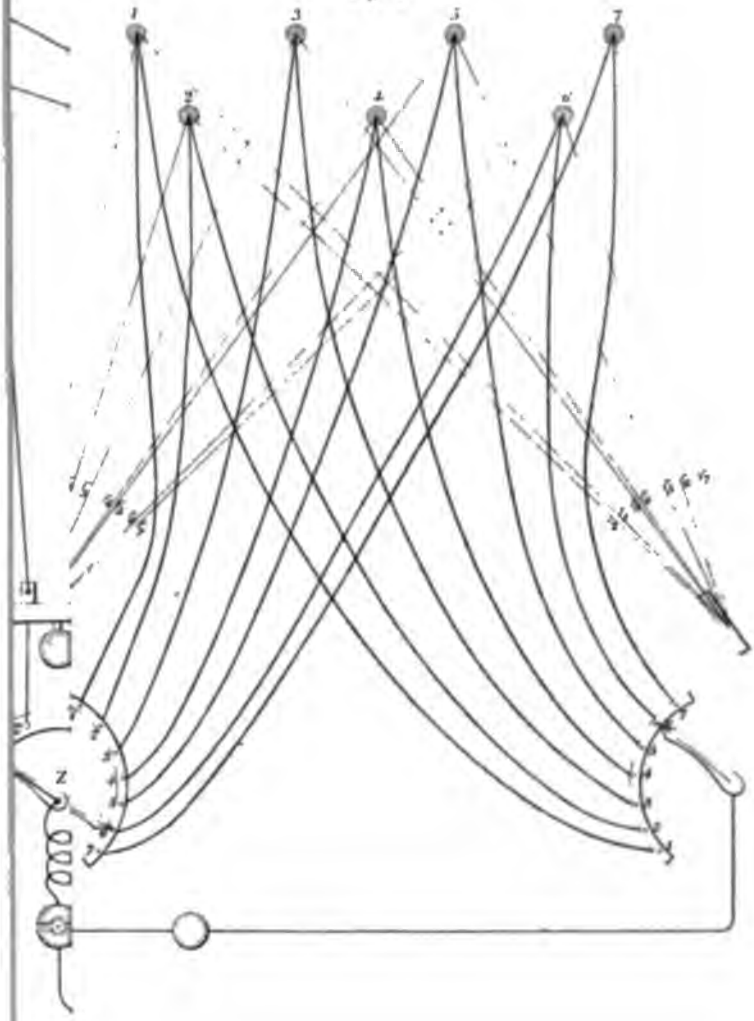


Fig 8

[illegible]

to be placed in localities where the difference between ebb and flood is considerable.

(c.) *Are Torpedoes alone a sufficient obstruction?*

To this question we must answer "no." Suppose three and four rows of torpedoes placed, and the enemy approaching, his vessels steaming in the wake of each other. The first three or four vessels may be destroyed, but the others will pass the gap thus opened.

The loss of the *Tecumseh* (Bay of Mobile, August 5th, 1864) did not stop Admiral Farragut's progress for a moment; and had even the whole width of the channel been obstructed by torpedoes, it was then, and it is to-day our belief, that the Federal fleet would have forced the passage.

Instead of Admiral Farragut's having lost but one ship on that day, he might have lost four or five by torpedoes, but the result would, after all, have been the same.

A somewhat different case is presented when a channel is not very deep; then a vessel sunk by a torpedo becomes in itself an obstruction to the progress of the vessel following in its wake.

(d.) *Torpedoes should always be placed in several rows, and en échellon.*

It is obvious that a single row of torpedoes cannot form an efficient protection one vessel, perhaps two vessels, may be sunk, but the others will pass. Several rows are therefore absolutely required. The torpedoes of one row are best placed *en échelon* to those of the other row, as thereby the probability of a vessel touching a torpedo in one or another row is considerably increased.

(e.) *Where are Torpedoes advantageously employed?*

1. In any channel the depth or bottom of which makes any other obstruction impracticable.

2. In case of an emergency, when it is of importance to effect the obstruction of a channel in the shortest possible time.

3. As auxiliary to other obstructions, rendering them doubly dangerous to the enemy; especially to close a gap in a line of obstructions.

4. In offensive operations against the enemy (see Chapter XIX.).

5. On the glacis of field-works; in front of a position which it is anticipated the enemy will attack; on the breach which the enemy has effected for the purpose of assaulting a work.*

(*f.*) *Anchoring of Torpedoes.*

The want of success of the floating obstructions used during the North American war may chiefly be attributed to the defective manner in which they had been anchored. Torpedoes placed during the first two years of the war have been found washed ashore after some heavy blow, or have even been met by blockade-runners making for the port of Charleston or

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* To show the value of the land-torpedo we refer to the following instances:—

1. Benjamin F. Butler, with his corps, attacked the small garrison of Drewry's Bluff (Fort Darling), below Richmond, on James River. The enemy had already succeeded in gaining a foothold on the narrow strip of land that lies between the foot of the bluff and the bank of the river, and were preparing for a further attack, which the decimated Southern regiments, in spite of all bravery, would hardly have been able to repulse, when some torpedoes that had been placed here by their explosion caused the enemy to commence a hasty retreat.

2. General Robert E. Lee's army of Northern Virginia had been so much reduced by the long struggle that it was often impossible to cover the long front which was threatened by the superior force of the enemy with more than one long-stretched line of infantry placed in two ranks. (In reconnoitring his position one day during the last campaign, General Lee is said to have exclaimed, in pointing to the thin, long-stretched line, "We are very elastic, gentlemen.")

On former occasions, like that which occurred during the attack on Drewry's Bluff, the enemy had learned to appreciate the danger of land-torpedoes. Generally the gaps left in their lines for the passage of artillery and waggon-trains had been marked by little flags, a circumstance which was adroitly used by General Pickett, who, in front of the weakest point of the position occupied by his division, caused a few such flags to be placed. The enemy attacked in superior strength, but could not be induced to pass the line of these imaginary torpedoes. Land-torpedoes were also used in the defence of Battery Wagner, without, however, causing serious losses to the enemy, who was cautiously advancing with his sap.

Mobile. It was soon observed by Confederate engineers, that rope, if even of the best quality and marlined, could not withstand the twisting and chafing to which the anchor-cable of a torpedo is exposed in a rapid and changing current. Towards the close of the war, all torpedoes were secured to their anchors by chains or wire cable.

The anchor-cable should, at both ends, be attached to swivels, so as to prevent any twisting by the current; if the depth of the channel is considerable, intervening swivels should also be placed in the chain.

The Austrians make the weight of the anchor seven times the weight of the torpedo; others are satisfied with three and four times the torpedo-weight; and we consider that the form and the weight of the anchor should entirely depend on—

(*a.*) The strength of the current in which the torpedo is placed.

(*b.*) The surface exposed by the torpedo to the current.

(*c.*) The nature of the bottom of the channel.

It is obvious that an anchor of just sufficient weight to hold the torpedo in its position is all that is required; and in localities where there is no current, or but little, it would appear a superfluous precaution to make the anchor so very heavy as seven times the weight of the torpedo.

However, it is certainly a less fault to make the anchor too heavy than it would be to make it not heavy enough.

The shape of the English umbrella-anchor would appear the most suitable for all soft bottoms.

(*g.*) *Torpedoes should not be discoverable on the surface of the water.*

It is not necessary to point to the reasons for this assertion. The vigilant sailor will look out for the least indication of the presence of torpedoes, and it is therefore absolutely necessary to give the torpedo a form which to the current offers the least possible resistance, and prevents it from forming ripples o surface. For this reason, percussion-torpedoes, with triggers reaching to very near the surface, are objectionab

All suspicious movements along the shore or bank sl be avoided.

The deeper the torpedo is placed below the surface o water, the easier it will be to conceal its presence fron enemy.

If it should be desired to buoy out a channel throug lines of torpedoes, through which friendly vessels may some decoy-buoys should also be placed, by which to mi the enemy.

(*h.*) *Influence of salt water on the Torpedo.*

Cast-iron cases, coated with some composition that pro them against the action of the water, would seem to be most suitable for envelopes of submarine charges.

In justice to the American barrel-torpedo, however, would call attention to the following fact:—

A few days after Admiral Farragut had forced his pas by Fort Morgan, several torpedoes were placed across mouth of Dog River. This was in August, 1864.

In May and June, 1865, the mouth of the river was sear for these torpedoes, and most of them found and removed. powder in them had kept perfectly dry.

In April, 1867, nineteen months after the torpedoes been placed, a flat loaded with boards, and coming from Ba saw-mill, on Dog River, struck one of the three or four torpe that had not been found, and was sunk by its explosion.

(*i.*) *Advantages and Defects of Torpedoes.*

The advantages of the torpedo consist in :—

1. It may be placed in any channel or approach, and even be used on land.

2. Its cost-price is comparatively cheap, and its construction requires but little time.

3. It is easily and quickly placed.

4. Its effect on a vessel is more destructive than that of the fire of any piece of ordnance known.

5. It is easily transported, and may even accompany an army in the field.

6. After the necessity of obstructing a channel has passed, the torpedo is easier removed than any other obstruction.

7. In connection with other obstructions, the torpedo renders it impossible for any fleet to force a passage under the fire of properly constructed shore-batteries.

8. Its moral effect is such as to cause the enemy to advance with the utmost caution; causing him to lose time which must be of great value to the attacked party.

On the other hand, the disadvantages and defects of the torpedo have thus been enumerated: —

1. It interferes with the movements of friendly vessels (The electric torpedo is the only kind not liable to this objection.)

2. The risk that the explosion may not be effected at the right moment. (In this regard self-exploding contact-torpedoes deserve the preference.)

3. The ease with which the enemy may cause torpedoes prematurely to explode, prevent them from exploding, and even remove them. Although it will be difficult to devise a protection against torpedoes sunk to a great depth, torpedoes which had been placed nearer to the surface have, during the North American war, been fished up by means of a very simple contrivance:— Two trees, 40 to 50 feet long, were lashed together, in the shape of an ${}^{1}_{4}\times{}^{2}_{3}$: the bow of the vessel entered between 1 and 4 in this ×, which was now lashed to the ship: 1-2, 2-3, 3-4 were then connected by strong fishing-nets, that had some weights attached to them. Admiral

Dahlgren is said to have saved several of his vessels off Charleston by this simple arrangement. By anchoring torpedoes to heavier anchors than those that were used in Charleston harbour and Mobile Bay, it is, however, our belief that torpedo-nets of this description will be made of little avail to a vessel in motion.

The dragging for torpedoes, which are placed within effective range of shore-batteries (and thus they should always be placed) is an operation exposing the men in the boats to too severe a fire for making it possible for them to perform their task in a thorough manner. But after the shore-batteries have become silent, a thorough sweeping even does not always remove all danger. (See Admiral Thatcher's Report, Chapter XVII.)

In any case, torpedo-nets are not a perfect protection for vessels in motion against stationary torpedoes; and dragging or sweeping for torpedoes is an operation that, during day-time, should be rendered impossible by the fire of shore-batteries, and during night be prevented by the vigilance of picket-boats. Stationary floating torpedoes, which are connected with each other by side lines, are very likely to sink or seriously injure a vessel, in spite of her torpedo-net.

(*k.*) *Comparative Cost-price of the several classes of Torpedoes.*

The simpler the construction, the less will be the cost-price of the torpedo. Torpedoes which are to be fired by electricity, especially when self-exploding contact-torpedoes, will cost fifteen and sixteen times the sum required for the construction of a torpedo fired by friction or acids. And, inasmuch as the friction self-exploding contact-torpedo is fully equal in effect to the electric, the question arises whether it will not be judicious to use the means at hand in constructing a larger number of the former, thus covering a greater space, even

CHAPTER XIX.

TORPEDOES USED IN OFFENSIVE OPERATIONS.

(a.) Torpedoes floating freely, and driving with Currents and Winds.—(b.) Torpedo Boats.—(c.) Torpedo Rockets.

WHATEVER importance the torpedo as a defensive means may have, its full value will be developed only when science, ingenuity, and mechanical skill combined shall have overcome the difficulties which during the North American war prevented its more frequent use in offensive operations.

Torpedoes used in offensive operations may be classed as follows:—

(a.) *Torpedoes floating freely and driving with Currents and Winds.*

It is obvious that the least effective torpedo is that which is left to float towards the enemy's shipping or bridge at the mercy of currents and winds. The most trifling thing—a snag, for instance—may stop it, or it may be washed ashore long before it has reached its intended scene of action. Even if the torpedo be provided with a propelling mechanism (which must necessarily always be somewhat complicated) there can be no certainty in its movements.

Moreover, since this class of torpedoes float on the surface, they are readily discovered by a vigilant enemy and therefore readily sunk.

During the North American war they have been repeatedly used, but in all instances with very unsatisfactory results.

When they were to be fired by acids, and had been provided with a clock-work, their explosion was generally effected at the desired moment, that is, after the time according to which the clock-work had been set had elapsed.

There are so many favourable circumstances required for the success of this torpedo, that its success will ever entirely depend on chance; even the probability of success will, under the most favourable circumstances, be very doubtful.

It was said that several Federal transports had been sunk on St. John's River by floating torpedoes of this class. Not having been able to ascertain the correctness of that rumour, we give here the following instance, which, in all likelihood, is at the same time the nearest approach to success ever attained with this class of torpedoes:—

EXTRACT FROM THE REPORT OF REAR-ADMIRAL DAVID D. PORTER.

"NORTH ATLANTIC SQUADRON, U.S. FLAG-SHIP *Malvern*.
"Cape Fear River, Feb. 22nd, 1865.

"SIR,— I have the honour to inform you that Wilmington has been evacuated, and is in possession of our troops. • •

"After sounding and buoying out the Middle Ground at Big Island, I succeeded in getting the gun-boats over, and opened fire on Fort Strong, the work commanding the principal obstructions.

• • • • • • •

"That night (the 20th), the rebels sent down 200 floating torpedoes; but I had a strong force of picket-boats out. The torpedoes were sunk without musketry. One got in the wheel of the *Osceola*, and blew her wheel-house to pieces, and knocked down the bulkheads in-board, but there was no damage to the hull. Some of the vessels picked up the torpedoes with their torpedo-nets. The next morning I spread two fishing-nets across the channel. • • • • •

• • • • • • • •

"DAVID D. PORTER,
"Rear-Admiral.

"Hon. GIDEON WELLES,
"Secretary of the Navy."

It will be granted that this unsuccessful attempt (and yet the most successful of all made during the North American war) at destroying the enemy's ships by torpedoes driving with current and wind is not calculated to awaken faith in this mode of applying the torpedo to offensive operations.

The way in which blockaders may protect themselves against these floating torpedoes is very simple and very efficient, as may be seen from Admiral Porter's report.

A light boom, a net, two or three cables supported by floats, stretched across a channel, will form an efficient protection against floating torpedoes. If the channel is wide, every vessel may readily take her own measures of protection, by placing a net, a raft, a boom, &c., around her.

(*b.*) *Torpedo-Boats.*

It may be affirmed to be the opinion of all naval authorities that a boat by means of which torpedoes may with the greatest secrecy and safety be brought into contact with the enemy's vessel and exploded at the moment of touching without damage to the operator, will form hereafter an essential part of all judicious arrangements for coast-defence. The conviction of the importance of torpedo-boats has already turned the attention of naval engineers to them.

The first attempts aimed at submarine boats, since these only could approach the enemy unobserved. The very unsatisfactory results from the use of this class of boats during the late American war alone would justify us in declaring against them.[*]

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[*] The first of these boats was built in 1861 at the Tredegar Works, Richmond, Va. It was only 20 feet long, built of boiler-iron, and intended to be used as a diving-bell, from which to attach a torpedo to the bottom of a vessel. It was an utter failure. Better prospect of success seemed to warrant a submarine boat built at Mobile in 1863. Its inventor was so sanguine of success, that he induced, the military authorities to send the boat by railroad to Charleston. In her first attempt at leaving this harbour for the Federal fleet, the boat filled with water, and sunk with her crew (three men), who were drowned. Raised again, a second attempt was made, but led to the same result. Raised a second time, the boat was used by Lieutenant Glassell in his attack on the New *Ironsides*, Oct. 6th, 1863 (see p. 304).

Plate XII

Fig 5

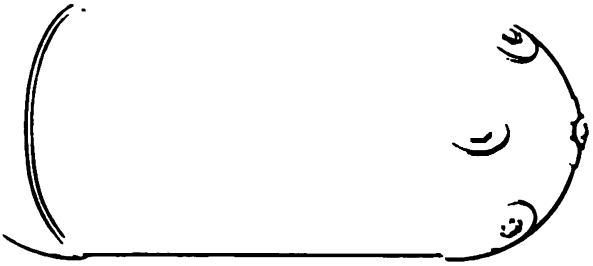

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Fig 4

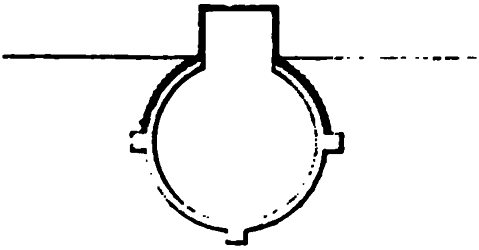
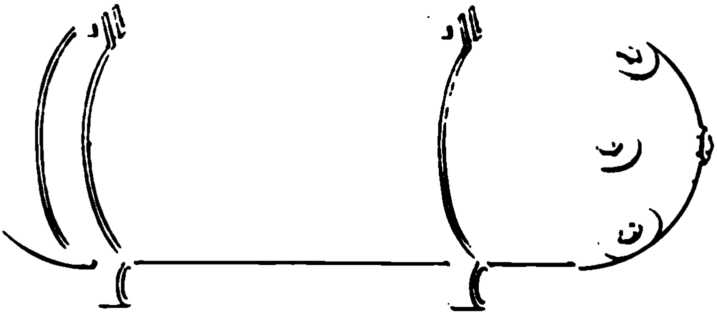


Fig 6



More recent attempts in the United States' navy also to construct such boats have been equally resultless.

There are two conditions to be fulfilled :--

1. The speed of the boat must be great enough to enable the boat to advance at least one mile and retreat the same distance without the necessity of coming up to the surface.

2. Its course under water must be accurately determinable.

The first condition is difficult to fulfil, because it involves the intricate question of the motor to be employed.

To fulfil the second question is well-nigh impossible, and for this reason American engineers reject submarine boats entirely. In the numerous trial-trips which various inventors who had offered their submarine boats to the United States' Government had to make, it invariably happened that the boat deviated from the prescribed course after going a few knots, and missed the appointed mark considerably; the boat sometimes even, to the great astonishment of those in it, coming up near the starting-point.

Steam cannot be employed as motor for submarine boats, because the maintenance of the fire requires too much air, and, moreover, the escape of the smoke would betray the presence of the boat. Constructors, therefore, turned their attention to compressed air and man-power; but the latter will never suffice to turn a screw so as to attain the required speed, and all trials have proved unsatisfactory.

The expansion of compressed air has been selected by the French as the motor: they thus obtain the advantage that they need no separate chamber for supplying the crew with air. More recently, however, compressed carbonic acid has taken its place among motion-generators. As it is solidified under a pressure of forty atmospheres, it occupies very little space; it still expands under a pressure of about twenty atmospheres, and is, therefore, probably the most compact material for the feeding of engines hitherto discovered.

At the Paris Exhibition of 1867 the model of a submarine torpedo-boat was exhibited. As it was not allowed to make any sketches of the model, which had also been placed under a glass-case, the following description can make no pretension to great accuracy:—

The plan of the boat originates in France. As motor, compressed air is to be used. The boat is entirely built of iron. Its ribs have a ⊐ and I section. Its sides are formed of strong sheet-iron.

Length from stem to stern, 43·3 m.; height, 3·36 m.; and width, 7·5 m.

The deck has a top (long, 20 m.; wide, 2·25 m.; and high, 1·4 m.) equally constructed of iron ribs and sheet-iron.

These, for a submarine boat, very large dimensions are necessary, because the air required for the crew and for the feeding of the engine will, even in a compressed state, fill a large space.

The boat is propelled by a screw, 2·25 m. in diameter, which is placed in the ordinary way, between the rudder and stern-post.

The shaft of the screw has two cranks, to which are attached the piston-rods of the cylinders. These stand in an inclined position. Twenty-one copper cylinders, with rounded-off ends, serve as receptacles for the (to 13 atmospheres) compressed air. These cylinders connect with the supply-pipe of the engine, and with another pipe, by which the crew is supplied with air. By means of valves, these pipes may be shut or opened. The cylinders are eight feet long, and contain about 130 cub. m. air compressed to 13 atmospheres. A small pump may also be moved by compressed air. It serves to fill or empty the water-reservoirs near the bottom of the boat.

There is also an apparatus on board (of which it is only said that) by means of which the boat may, with a single turn of hand, be instantly lowered or raised to the surface. This mysterious contrivance is, probably, a cylinder having a capacity of a certain number of gallons of water, which, by means of a piston moved by compressed air, may be rapidly filled or emptied.

The above-mentioned top of the deck forms part of the pilot-house, and is, therefore, provided with a glass-window. It has also four man-holes (similar to those in steam-boilers), through which the crew may pass in and out of the boat. The middle part of this top is bent to the shape of the life-boat, which is secured to it by some screws reaching to the interior of the top. The life-boat is constructed similar to the large boat, and perfectly air-tight. It is 8·25 m. long, 2·25 m. wide, and 1·25 m. deep. It has also four man-holes, two of which fit exactly over two man-holes in the top of the deck, serving as communication with the large boat; while the remaining two, which are on the side of the life-boat, are probably intended for the passing of oars.

The steering-apparatus of the boat presents no extraordinary feature. In addition to the main rudder, there are two horizontal rudders, 2 m. long, moving on the same axle near the stern. A small screw, moving on a vertical shaft above the boat, is intended to increase the speed with which the boat may be raised or lowered.

The torpedo-spar is an immovable tube 4·5 m. long; to it is attached a cast-iron torpedo, which is to be fired by electricity. Its insulated wire leads to the battery stationed in the pilot-house.

The boat is liable to the following objections:—

1. As a submarine boat it is impossible to give it the right course, with any reasonable degree of certainty, to strike the enemy's vessel.

2. Submarine boats are so dangerous to their own crew, that it will matter but little whether or not such a boat is provided with a life-boat. Judging from the small number of survivors of the disasters of the *Patapsco* and *Tecumseh*, it is more than probable, that in case of accident, the crew of a submarine boat would have but little time to make their egress

through the man-holes into the life-boat, unscrew its bolts, and save themsleves. The theory may be good, but for practical use it appears worse than useless.

3. The two horizontal rudders, and the small screw moving on its vertical shaft above the deck, are entirely insufficient to give to a boat of the dimensions above described the direction desired.

4. The torpedo-spar of a torpedo-boat should be movable in a vertical plane.

5. Self-exploding contact-torpedoes are more suitable for torpedo-boats than torpedoes to be fired by electricity from the interior of the boat.

Plate XII. represents a torpedo-boat built during the North American war at Mobile. Those built at Savannah were of a very similar construction. The only real defect in these boats was the boiler, in which salt water would foam, but not form steam. Neither was the fuel used the proper material for generating steam on occasions which, like those in question, are dangerous enough in themselves, even if the enemy be not warned by a column of smoke of approaching danger.

All these boats were propelled by screws; they had a length varying from 40 feet to 60 feet; midships a diameter of 7 feet, and tapered at both ends to a point like a cigar.

The torpedo-spar, to which a contact-torpedo (figs. 5 and 6) was attached, had a length of from 10 feet to 12 feet. The following are extracts from official reports made by officers of the United States' navy in regard to operations of this class of boats:—

Attempt to blow up the New Ironsides.

REPORT OF CAPTAIN S. C. ROWAN.

"UNITED STATES' STEAMER *New Ironsides*,
"Off Morris Island, South Carolina, October 6th, 1863.

"SIR,—I have the honour to report the circumstances attending the explosion of a torpedo against the side of the ship last night at a quarter past nine o'clock. About a minute before the explosion a small object was seen by the sentinels and hailed by them as a boat, and also by Mr. Howard, officer of the deck, from the gangway. Receiving no answer, he gave the order, "Fire into her." The sentinels delivered their fire, and immediately the ship received a very severe blow from the explosion, throwing a column of water upon the spar-deck and into the engine-room. The object fired at proved to be (as I subsequently learned from one of the prisoners) a torpedo-steamer, shaped like a cigar, 50 feet long by 5 feet in diameter, and of great speed, and so submerged that the only portions of her visible was the coamings of her hatch, which were only two feet above the water's edge and about ten feet in length.

"The torpedo-boat was commanded by Lieutenant Commanding Glassell, formerly a lieutenant in our navy, and now our prisoner. He states that the explosion threw a column of water over the little craft, which put out the fires, and left it without motive power and it drifted past the ship.

"Nothing could be seen from the gun-deck, and to fire at random would endanger the fleet of transports and other vessels near us. The marine guard and musketeers on the spar-deck saw a small object, at which a very severe fire was kept up until it drifted out of sight, when two of the Monitors, the *Weehawken* and *Catskill*, passed under our stern and were close to it, when it suddenly disappeared; two of our cutters were despatched in search of it, but returned without success.

"I hope our fire destroyed the torpedo-steamer, and infer the fact from the statement of Lieutenant Commanding Glassell, who acknowledges that he, and Engineer Toombs, and pilot, who constituted the crew at the time of the explosion, were compelled to abandon the vessel, and being provided with life-preservers, swam for their lives. • • • •

"Very respectfully, your obedient servant,

"S. C. ROWAN,
"Captain Commanding.

"REAR-ADMIRAL J. A. DAHLGREN,
"Commanding S.A.B. Squadron."

Sinking of the United States' Steamer "Housatonic" by a Torpedo-David.

"UNITED STATES' STEAMER *Canandaigua*,
"Off Charleston, S.C., Feb. 18th, 1864.

"SIR,—I have the honour to make the following report of the sinking of the United States' steamer *Housatonic*, by a rebel torpedo off Charleston, S.C., on the evening of the 17th instant.

"About 8·45 P.M., the officer of the deck, Acting Master J. K. Crosby, discovered something in the water about 100 yards from and moving towards the ship. It had the appearance of a plank moving in the water. It came directly towards the ship; the time from when it was first seen till it was close alongside being about two minutes. During this time the chain was slipped, engine backed, and all hands called to quarters. The torpedo struck the ship forward of the mizenmast on the starboard side, in a line with the magazine. Having the after pivot gun pivoted to port, we were unable to bring a gun to bear upon her. About one minute after she was close alongside the explosion took place, the ship sinking stern first, and heeling to port as she sank. Most of the crew saved themselves by going into the rigging, while a boat was despatched to the *Canandaigua*. * * * * * *

"Very respectfully, your obedient servant,

"F. J. HIGGINSON,
"Lieutenant.

"REAR-ADMIRAL JOHN A. DAHLGREN,
"Commanding S.A.B. Squadron."

The torpedo-boat which made this successful attack was lost, with its commander (Lieutenant Dixon, Confederate States navy) and crew. The torpedo having been placed at the bow of the boat, it is surmised that she went into the hole made in the *Housatonic* by the explosion, and having no power sufficient to back out, sunk with her.

Sinking of the Confederate Ram "Albemarle."

(*a.*) REPORT OF LIEUTENANT W. B. CUSHING.

"ALBEMARLE SOUND, N.C., October 30th, 1864.

"SIR,—I have the honour to report that the rebel iron-clad *Albemarle* is at the bottom of the Roanoke River.

"On the night of the 27th, having prepared my steam launch, I proceeded up toward Plymouth, with thirteen officers and men, partly volunteers from the squadron. The distance from the mouth of the river to the ram is about eight miles, the stream averaging in width some 200 yards, and lined with the enemy's pickets. A mile below the town was the wreck of the *Southfield*, surrounded by some schooners, and it was understood that a gun was mounted there to command the bend. I therefore took one of the *Shamrock's* cutters in tow, with orders to cast off and board at that point if we were hailed.

"Our boat succeeded in passing the picket and even the *Southfield* within 20 yards without discovery, and we were not hailed until by the look-outs on the ram. The cutter was then cast off and ordered below, while we made for our enemy under a full head of steam.

"The rebels sprung their rattles, rang the bell, and commenced firing, at the same time repeating their hail, and seemed much confused.

"The light of a fire ashore showed me the iron-clad made fast to the wharf, with a pen of logs around, her about 30 feet from her side.

"Passing her closely, we made a complete circle, so as to strike her fairly, and went into her bows on. By this time the enemy's fire was very severe, but a dose of canister, at short range, served to moderate their zeal and disturb their aim. Paymaster Swan, of the *Otsego*, was wounded near me, but how many more I know not. Three bullets struck my clothing, and the air seemed full of them.

"In a moment, we had struck the logs, just abreast of the quarter-port, breasting them in some feet, and our bows resting on them. The torpedo-boom was then lowered, and, by a vigorous pull, I succeeded in diving the torpedo under the overhang, and exploded it at the same time that the *Albemarle's* gun was fired. A shot seemed to go crashing through my boat, and a dense mass of water rushed in from the torpedo, filling the launch and completely disabling her. The enemy then continued his fire at 15 feet range, and demanded our surrender, which I twice refused, ordering the men to save themselves, and removing my own coat and shoes. Springing into the river, I swam, with others, into the middle of the stream, the rebels failing to hit us.

"The most of our party were captured, some drowned, and only one escaped besides myself, and he in a different direction.

* * * * * * *

* * * * * * *

The ram is now completely submerged, and the enemy have sunk three schooners in the river to obstruct the passage of our ships.

* * * * * * *

"I am, sir, very respectfully, your obedient servant,

"W. B. Cushing,
"Lieutenant United States' Navy.

"Rear-Admiral D. D. Porter,
"Commanding N.A. Blockading Squadron."

(*b.*) Report of Captain Warley, late Commander of the Confederate Ram *Albemarle*.

"Plymouth, North Carolina, October 28th, 1864.

"Sir,—The night of the 27th instant, a dark and rainy night, I had the watch on board doubled, and took extra precaution. At or about 3 o'clock a.m., on the 28th, the officers of the deck discovered a small boat in the river, hailed her, received an unsatisfactory answer, rang the alarm-bell, and opened fire on her with the watch. The officers and men were at their quarters in as quick time as possible under the circumstances, but the vessel was so close that we could not bring our guns to bear, and the shot fired from the after gun loaded with grape failed to take effect. The boat running obliquely, struck us under the port bow (running over the boom), exploded a torpedo, and smashed a large hole just under the water-line. Under a heavy fire of musketry the boat surrendered, and I sent Lieutenant Roberts to take charge of her. Manned the pumps, and ordered to fire up to use the donkey pumps. The water gained on us so fast that all our exertions were fruitless, and the vessel went down in a few minutes, merely leaving her shield and smoke-stack out of water.

"In justice to myself, I must say that the pickets below gave no notice of her approach, and the artillery which was stationed near the vessel for protection gave no assistance, manning only one piece at too late a time to be of any service. Having condensed this report as much as possible, I respectfully request a court, to establish on whose shoulders rests the loss of the *Albemarle.*

"Hon. S. R. Mallory,
"Secretary of the Navy, Richmond, Va."

Attack on the "Minnesota" by a Torpedo Boat.

(*a.*) Report of Lieutenant-Commander J. H. Upshur.

"United States' Steamer *Minnesota,*
"Off Newport News, Va., April 9th, 1864."

"Sir,—I have to report that last night, about 2 o'clock, while riding to the ebb tide, a dark object was discovered slowly passing the ship, about 200 yards distant. It was thought to be a boat, and hailed; to the hail was answered, *Roanoke.* By this time it was directly abeam, seemingly without any power of locomotion. The officer of the deck promptly gave orders to the tug astern to go and exan it, and repeated his orders several times before getting reply; and while endeavouring to have this order execu the object, a "David," approached the ship just abaft the main chains and exploded a torpedo under her, the "Dav making off in the direction of the Nonsemond River. Sev muskets and a round shot were fired at it, and every ef made to send in pursuit; but the tug *Poppy* had failed keep the required look-out, and also had allowed her st to go down, which was not discovered until the "David" disappeared. Vessels were sent in search, but failed to her.

* * * * * * *

"It is difficult to say how far the ship may be damag although she manifests no leak. The shock was quite sev and I should be glad to have a survey to ascertain the ext of injury sustained.

"I am, very respectfully, your obedient servant,

"J. H. UPSHUR,
"Lieutenant-Commander,
"Commanding U.S. Steamer *Minne*

"ACTING REAR-ADMIRAL S. P. LEE,
"Commanding North Atlantic Blockading Squadron."

(*b.*) REPORT OF SURVEY.

"UNITED STATES' IRON-CLAD *Roanoke*.
"Newport News, Va., April 12th, 186

"ADMIRAL,— * * * *

"*Description of Injury.*

"Port after shell-room.— First and third futtocks of t frames badly sprung. The diagonal straps sprung off. T deck sprung, nine planks being sprung off from the bea about three-fourths of an inch. The linings of the bulkhe sprung badly. Amidship bulkhead started inboard about inches.

"Spirit-room.—Forward frame broken. Planking sprun

Second frame badly sprung. Bilge streak broken and sprung off. Third frame sprung. Planking sprung outboard from timbers about one inch, two butts of second bilge streak sprung up. Decks started up. One deck plank broken over the spirit-room.

"The centre of the injury appears to be about 10 feet below the surface of the water. The shelving of the port magazine started. Port steerage-bulkhead broken. One ladder broken, and all the rest unshipped. Nine deck planks of port steerage broken. In the port after-magazine the shelving has been shattered. Two butts on the gun-deck started upon the port side at No. 13 gun; seventeen planks from the water-way; two axletrees on gun-deck broken, and one on spar-deck broken of 9-inch gun-carriages. Two lower half-ports on spar-deck, and two lower half-ports on gun-deck broken; preventive plate for main-channel, next to after one, sprung out about half-an-inch. One of the bolts of the crane for spare spars in the main chains started one inch. The paymaster's store-rooms in the cockpit on the port side show the power of the concussion, all the shelves being broken and disarranged. Carefully examined the outside of the ship abreast of the place of injury, and were unable to find any of the copper torn off, or any inequalities on the bottom of the ship. The bulkhead of the shaft-alley, abreast of the shell-room, started inboard about six inches for a distance of 15 feet on the port side.

"The binnacle on the quarter-deck forward of the mizenmast unshipped from its pedestal on the bridge and thrown three feet towards port side.

"Very respectfully, your obedient servants,

"GUERT GANSEVOORT,
"Captain.
"JOSEPH FYFFE,
"Lieut. Commanding U.S.S. *Commodore Morris*.
"J. W. STIMSON,
"Carpenter.

"ACTING REAR-ADMIRAL S. P. LEE,
"Commanding N.A.B. Squadron."

Attempt of a Torpedo-David to blow up the United States' Steamer "Memphis."

"UNITED STATES' STEAMER *Memphis*,
"North Edisto River, S.C., March 6th, 1864.

"SIR,—I have the honour to report that an attempt has been made by the rebels to blow up this ship, but am happy to state did not succeed.

"At 1 A.M. a torpedo-boat was discovered about 50 yards distant, approaching us rapidly on the port quarter from up the river. We immediately beat to quarters and slipped the chain. In an instant the torpedo was under our port quarter, and we could not bring a gun to bear on her. The watch being armed at the time, we were enabled to concentrate a rapid fire with muskets, revolvers, and pistols down upon her, and into what looked like a hatchway, nearly in the centre. The rapid firing seemed to stop her progress, and dropping about 12 feet astern, in an instant she darted ahead again, and at the same time we rang to go ahead, and our propeller, I think, must have caught and broke some of her gear, as she appeared to be disabled and drifted up river. In a few moments they showed a light, at which we fired a 12-pound rifle shot. She then disappeared, and an armed boat was immediately despatched to search for and capture her if possible, but returned without success. This torpedo-boat was about 25 feet long, painted lead colour, and in appearance was like a ship's boat in the water bottom up.

"I am, sir, very respectfully, your obedient servant,

"R. O. PATTERSON,
"Acting Master Commanding.

"CAPTAIN S. C. ROWAN,
"Commanding S.A.B. Squadron."

Torpedo Attack on the Wabash.

"UNITED STATES' STEAMER *Wabash*,
"Off Charleston, S C., April 19th, 1864.

"SIR,—I have to report that last night, at about 9.45, an object was discovered by Ensign Charles H. Craven, the officer of the deck, on the starboard quarter, distant about 150 yards, which corresponded in shape and movements to the torpedo-boat which sunk the *Housatonic*. It moved rapidly up against tide till about the mainmast, then turning stood directly for the ship. Ensign Craven opened fire with musketry; beat the gong for the crew to assemble at quarters; rang four bells for the engine to go ahead; opened fire with the watch with the starboard battery, and gave orders for slipping the chain. The men rushed quickly to their quarters; the ship moved ahead; the chain was slipped, and when the object was being left in the quarter, distant at the time about 40 yards, a round shot is supposed to have struck it; at all events, the second shot struck in its immediate vicinity and it was seen no more. One round shot was fired from each of the spar-deck guns on the starboard side, and the crew were kept at their quarters, while, with the helm hard a-port, the ship kept cruising round the spot.

"The marines were also stationed along the starboard side, where they could use their pieces to advantage. Signal was made to the effect that 'rams were coming,' as that most likely to place the other cruisers on their guard. * * *

* * * * * * * *

"I am, sir, very respectfully, your obedient servant,

"J. DE CALB, Captain.

"COMMODORE S. C. ROWAN,
"Commanding S.A.B. Squadron."

As above mentioned, several torpedo-boats had been built at Savannah and Mobile: at Selma, also, a David, the *St. Patrick*, had been completed during the fall of 1864, but with exception of the attempts described not one of these boats ever left their harbour. A David proceeded from Mobile to Navy Cove (near Mobile Point) in May, 1864, with the intention of attacking a blockade stationed near Sand Island. In the attempt to go out the David burst the boiler, one man of the crew was killed instantly, the other had his leg broken, and the boat was made a perfect wreck.

The want of suitable boilers and engines may be designated as the chief reason why torpedo-boat attacks were not more frequently made from the Confederate side. To the Federal navy, on the other hand, but little opportunity was offered for making use of the torpedo in this class of offensive operations.

There is, in fact, but one single instance recorded of the Federals having made a torpedo-boat attack. This is the successful attempt of Lieutenant Cushing to destroy the Confederate ram *Albemarle.* The daring courage displayed on this occasion by Lieutenant Cushing and his party could not but elicit the admiration of even his enemies. The attack on the *New Ironsides,* made by Lieutenant Glassell in Charleston Harbour (Oct. 6th, 1863), required an intrepidity and courage which show that in the Confederate navy, also, men could be found who, without hesitation, would volunteer for the most dangerous service. But whether these officers and their gallant crews would have been willing to trust themselves into any one of the submarine-boats built during or since the war is a question which we are not at liberty to decide for them. The manœuvring under water of a submarine boat on a trial trip is connected with no more danger than threatens the diver in his diving-bell whilst performing his work on the bottom of a deep channel. The case presents quite a different feature, however, when the ingenious inventor is called upon to leave the secure harbour, and prove his faith in submarine boats by making an attack on the enemy's vessels.

A swift jolly-boat, rowed with muffled oars, and provided with a self-exploding contact-torpedo, fastened to the socket of a movable torpedo-spar, 12 feet long, seems to be preferable to any submarine boat.

At Mobile, several row-boats were built towards the close of the war, with the intention of using them as torpedo-boats against the enemy's shipping. They were very sharp at both ends, flat-bottomed, and provided with a deck for protection against musketry. Each boat was arranged for four oarsmen; the crew was to consist of six men in all. They were never used; yet it appears that boats of this description might be rendered very serviceable—for instance, as picket-boats, or to accompany an expedition made with the purpose of cutting out a vessel, &c.

The danger to the crew is, however, still so great, and the speed of the boat so unsatisfactory, especially if long distances are to be passed, that the plan more properly belongs to the class of make-shifts. American engineers require of a torpedo-boat to fulfil the following conditions:—

1. When submerged to the greatest admissible depth, the boat must have a speed of at least eleven knots. The greater the speed, the less is the danger of being discovered or being struck by the enemies missiles.

2. The engine must work without noise, and no smoke should be visible. The latter condition it is impossible to fulfil entirely where a steam-engine is used in the boat. By using very good coal or petroleum for fuel, the column of smoke may, however, be rendered so light that it is hardly discernible at a distance.

Experiments are now being made with compressed carbonic acid as a motor of torpedo-boat machinery.

3. The boat must obey the rudder. It should not be very long, and have twin-screws. As the boat is in comparison very broad and is drawing much water, it is admissible to make the diameter of the screws large.

4. The crew should be protected against musketry and the fire of light artillery.

This is effected by submerging the boat to within 18 inches of its deck, and by plating the deck and the sides of the boat with iron plates from 1½ to 2½ inches thick.

The necessity of plating parts of the boat with iron entails the necessity of increasing the dimensions of the boat, and boats to the length of 85 feet with a width of 18 feet have been built. The deck has two man-holes, the iron-clad pilot-house reaches only a few inches above the deck.

It may be observed here that all officers commanding the Monitors which were engaged in the first attack on Fort Sumter complained of the limited field of view from the pilot-house. The torpedo is attached to a curved wooden spar, which may be lowered or raised in a vertical plane. The spar is curved in order that it may break so soon as the explosion occurs, and the direct re-action of the torpedo on the boat thus be prevented.

The torpedo is contact self-exploding, contains a charge of 50 pounds of powder, and is made of iron ¾ inch thick. Friction fuzes are used. The materials used in the construction of the boat are iron and wood—for the sides and deck 4½-inch oak plank. Ventilation is secured below deck by a fan turned by the boat's engine.

An essential point is the motion of the rudder, which, the boat being submerged, must be so arranged that no water can enter. This is effected by means of a stuffing-box which is attached to the stern-post of the boat, and contains two cog-wheels connected with the tiller.

The boat's crew consists of from six to eight men.

(*c.*) *Torpedo Rockets.*

Superior speed will enable wooden vessels in most cases to elude the attempts of their iron-clad antagonists to destroy them by butting. During the earlier part of the North American war, two Federal frigates, the *Cumberland* and *Congress*, were sunk in Hampton Roads by the Confederate ram *Virginia* (late *Merrimac*). In Roanoke River, also, the ram *Albemarle* engaged successfully several Federal gun-boats. The unsuccessful attempts of the Confederate flag-ship *Tennessee*, in the lower Bay of Mobile, August 5th, 1864, to make the *Hartford* or any other of the Federal vessels feel the sharpness of her prow, will, however, speak for the correctness of the above assertion.

Iron-clads have, in general, not speed enough to overtake a swift steamer endeavouring to avert their blows. This want of speed renders the iron-clad also less suitable for being used as a torpedo-boat, although a torpedo-arrangement will certainly, in many cases, add to the formidableness of the ram.

There is, however, a way in which torpedoes may be successfully employed in connection with iron-clads.

The latter will sometimes in action be so near one another that a torpedo-rocket can easily be fired from one vessel under water so as to strike the other. An example of this class was presented during the action between the *Virginia* and the *Monitor* in Hampton Roads on the day after the former had destroyed the *Cumberland* and *Congress*. The two vessels lay within a few yards of each other, neither being able to penetrate the armour of the other with shot. Here a torpedo-rocket might have been successfully employed, and it is probable that similar cases will not unfrequently occur.

It is evident that torpedo-rockets can be used with certainty of success only at very short ranges.

Several apparatus for firing such rockets have been proposed in America and in England; but these, as belonging strictly to the details of naval warfare, do not come within the limits of this treatise.

C.—METHODS FOR LIGHTING-UP CHANNELS.

CHAPTER XX.

Methods for Lighting-up Channels and Water-approaches.

THE importance of establishing a good system of lighting-up channels and water-approaches has been briefly referred to in a previous chapter. By means of their calcium-light, the Federals were enabled to continue, during even dark nights, the bombardment of Fort Sumter and Battery Wagner, rendering communication with these points an undertaking not without danger.

Confederate artillerymen in the batteries at Port Hudson were enabled by the light of piles of wood, set on fire on the right bank of the Mississippi River, to point their guns with some accuracy on the vessels of Admiral Farragut's squadron attempting to force the passage under cover of night.

Several instances are recorded in which the intended surprise of a detached work was changed into a hasty retreat by a timely discovery of the boats, which, under cover of a dark night, approaching the work, suddenly found themselves within an illuminated circle, and exposed to the well-directed fire of the battery which they had intended to surprise.

The Federal scouts, according to official reports, almost nightly approached the obstructions placed between Forts Sumter and Moultrie. One of them was even bold enough to cut the hawsers of the rope-obstructions, and after carried as many as twenty buoys back as trophies to the Federal fleet. With an apparatus for lighting-up the channel between the two forts, such attempts would have been rendered impossible.

In Mobile Bay, the Federal picket-boats are known to have approached the wharves of Forts Morgan and Gaines, and on one occasion came very near seizing and carrying off the sentry stationed at the very foot of Fort Gaines.

After Admiral Farragut had forced the passage by Fort Morgan, these boats were constantly hovering about the upper obstructions at night.*

It is evident, then, that it is of special importance to have a good method of lighting-up channel and water-approaches, particularly where detached works are exposed to a sudden dash of the enemy, or where there are gaps defended only by torpedoes, especially if they be to be fired from shore.

Fires built on flats or piles, suitably provided with a sort of fire-place, made of brick or clay, or large fires lighted on the bank of a channel opposite the shore-battery, will, in many cases, be excellent make-shifts when circumstances prevent the application of a better method for lighting-up water-approaches. Excellent as they may be in case of emergency, the judicious engineer, in maturing his plan for coast-defences, will provide a more satisfactory and more economical method for lighting-up the channels and approaches which are defended by his shore-batteries and obstructions.

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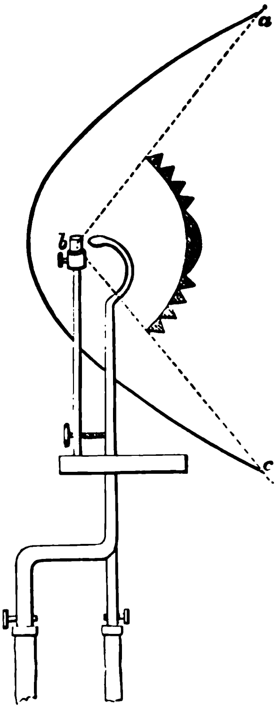
* 1. An unfinished iron-clad, the *Phœnix*, had been sunk during the night of August 8-9, to close a gap discovered near the south-east corner of the line of obstructions, distant about 1700 yards from the Batteries Gladden and M'Intosh, and within easy range of their guns. During the night of August 11-12, a sudden explosion attracted the attention of the Confederate picket-boats stationed near, but inside, of these obstructions; at daybreak, it was found that the Federals had attempted to blow up the *Phœnix*, an attempt in which they had partially succeeded.

2. The necessity of suitable means for lighting up a channel will be even more clearly shown by the following:—The gap left open in this line of obstructions for the passing in and out of Admiral Buchanan's little squadron had been closed during the night of August 6th by sinking several flats (always held in readiness) loaded with bricks. It was, however, deemed advisable in addition to strengthen the defence of the point by torpedoes, and Lieutenant Barnett (the same officer previously mentioned) was despatched in a skiff with two men and a number of torpedoes for this purpose. He had just passed the gap, and was about to begin planting the torpedoes, when he was suddenly hailed by an unknown boat, and on answering, being recognised as Confederate, found himself made fast to a strongly manned Federal cutter, and taken in tow. Hastily throwing his torpedoes overboard, he gave himself up for lost, when opportunely the Confederate picket-tug *Gunnison* came up, commenced firing, and the Federals, fearing capture, abandoned their prize and retreated.

Among the many excellent apparatus for signal-lights and lighthouses, or for lighting-up apparatus, which were exhibited at the Paris Exhibition of 1867, the following would appear the most suitable for war purposes:—

1. *The Apparatus exhibited by the Austrian War Department.*

The light used is the Drummond-light. As reflector serves a concave mirror, which has a diameter of 4 feet by a depth of 3 feet. This mirror is said to have been constructed by Professor Petzwall in Vienna, with a peculiar curvature, the object being to prevent dark streaks in the cone of light. The lime, enclosed in a tube, is placed in the focus as a support that may be moved by the hand. The oxy-hydrogen current is blown from the front on the lime, so that its part facing the mirror emits no light.



It is evident that by this arrangement that part of the reflector contained within the plane of the parameter does not all come into play. The degree of divergence of the cone of rays proceeding from the lime and passing out of the front opening of the mirror will thus depend on the size of the < *a*, *b*, *c*. To avoid this divergence, a Fresnel lens is placed in front of the lime, by which the diverging rays are refracted parallel. The reflector is capable of a horizontal and vertical movement.

The burner consists of a brass tube, that may be moved by hand. The extremity of the burner is of iron, and has a bore of ½ m.m. The union of the gases takes place somewhat far within the tube. Conducting pipes, 3 m.m. in thickness, are used, experiments having shown that these tubes are capable of standing the pressure. The two gases (oxygen and hydrogen) are contained in copper cylinders, which have been submitted to a pressure of twenty atmospheres. The gases are condensed by means of force-pumps till they have an elasticity equal to eight atmospheres. This pressure is measured by manometers. The flow of the gas is regulated by cocks, which are managed by hand.

The man appointed to this service must acquire by practice the necessary skill in regulating the flow of gas.

Obviously, for a long-continued illumination, several receptacles are required. In order to avoid interruption, the conducting tubes fork at their lower extremities, and thus a fresh cylinder can be attached, whilst the one that is in use is still at work.

Self-acting gas-regulators have been attempted, but hitherto in vain.

The apparatus is said to produce good illumination to a distance of from 3000 feet to 4000 feet, but the pressure must not be less than five atmospheres. The space well illuminated is said to have had a width of about 140 yards.

The weight of the whole apparatus, leaving out the condenser and gas-apparatus, is estimated at from 12 cwt. to 14 cwt.

The calcium-light has the peculiarity that it lights only on one side, namely, on that on which the stream of gas is thrown on the lime.

The reverse side of the piece of lime, which is at least half-an-inch thick, becomes red-hot. When that side of the lime on which the gas is thrown is turned towards the ground to be illuminated, it is necessary to have a very deep parabolic mirror, in order to reflect at least a part of the rays parallel. and all that part of the parabolic mirror which is lying behind the lime is entirely without effect. Without the lens placed in front of the lime, the Austrian apparatus would have much less effect.

The more proper mode would seem to be to turn the dark side of the lime towards the ground, that is, to throw the stream of gas from the direction of the reflector on the lime. But then a parabolic mirror is needed, which contains little more than that part of the paraboloid which lies behind the plane of the parameter, that is, a plane mirror.

Such mirrors, properly constructed and with a sufficiently large diameter—say three feet—are certainly very expensive, because the difficulty of construction mainly increases with the focal distance of the parabola.

The first-mentioned peculiarity of the calcium light, namely, that it lights only in one direction, is an absolute disadvantage in comparison with other illuminators, even though these exhibit no greater intensity when measured by the photometer.

A second defect is, that the effect is essentially dependent on the volume of gas and the pressure under which it is thrown on the lime.

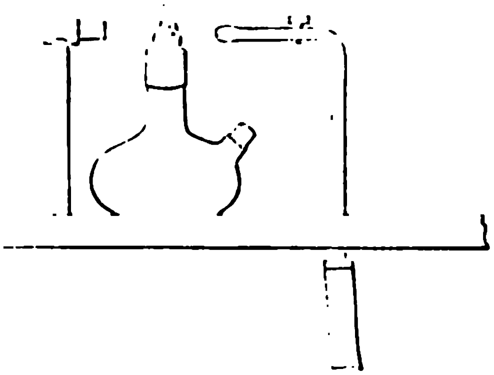
The Americans have given their gases an elasticity of thirty atmospheres. The Austrians admit that no satisfactory effect is produced with a pressure of less than five atmospheres. And even with this inconsiderable pressure, and a very small aperture, they consumed per hour twenty-five cubic feet of oxygen, and double the quantity of hydrogen. It then follows that a very large quantity of gas must be kept on hand. When the gas is forced out of india-rubber bags by mechanical pressure, several burners are required, in order to counterbalance the comparatively weak pressure which the bags will bear. The consumption of gas will not be less.

A considerable number of bags are, therefore, required. If instead of these, metallic holders and condensed gas are used.

which will be more effective, three or four sets will suffice. But, on the other hand, gasometers and large india-rubber balloons will be required to collect the prepared gas, and also condensers to force it into the metallic holders.

If we consider, in addition, the equally indispensable apparatus for the making and purifying the gas, the use of which requires much attention, we shall then have a very complicated arrangement, many of whose parts must be in immediate proximity with the lighting apparatus, since long gas-tubes are impracticable, and, if practicable, would work badly.

The Lime-light of Captain Frank Bolton.



The exhibited apparatus is more especially intended for signal purposes; the manner in which the lime-light is produced is, however, so simple, that the principle involved might also be applied to the purpose of lighting-up channels and water-approaches. The applicability of the apparatus to similar purposes has, in fact, been proved by the satisfactory results of experiments made with an apparatus of larger size than the one exhibited, in which a reflector two feet in diameter was used.

Pulverized lime[*] is formed into cylinders $1\frac{1}{2}$ inch long and 1 inch in diameter. One end of a cylinder is held in a case, the other end is almost in contact with a flame of alcohol, which is fed by three wicks. Through this flame a stream of pure oxygen is blown on the lime. The aperture of the burner is hardly $\frac{1}{2}$ m.m. in diameter. The oxygen is contained in an india-rubber bag of about four cubic feet capacity. The whole arrangement is exceedingly simple and practical. All utensils and materials, those needed for the preparation of the gas included, can be packed into a box of about six cubic feet capacity.

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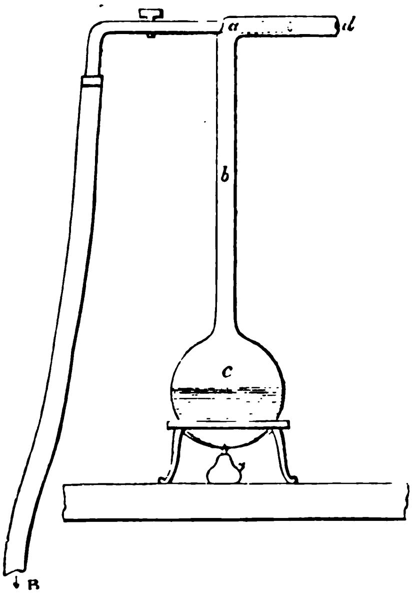
[*] The preparation of the pulverized lime is a secret, which belongs to Mr. John Warner, No. 11, Northampton-square, London, who is the maker of Captain Bolton's apparatus.

Mr. R. Sabine's Light (Petroleum and Oxygen).

During the late North American war, vessels were often under the necessity of effecting an entrance into the mouths of rivers or inlets where there either never had been any light-houses or where they had been destroyed.

An officer of the United States' navy, having a lens-apparatus on board of his vessel, fell upon the idea of using it in connection with a petroleum light as a means of illumination. In order to intensify the light, he introduced a stream of atmospheric air.

Later, instead of atmospheric air, pure oxygen was used; it is forced through the ignited vapour of boiling petroleum. Very satisfactory results are said to have been obtained with this light.



The apparatus is exceedingly simple: a double burner (*d*) connects by means of the interior tube (*a*) with an india-rubber bag containing the oxygen; by means of the tube (*b*) the burner is connected with the boiler (*c*) in which the petroleum is heated. Tube (*a*) has an aperture of ¼ m.m.; tube (*b*) an aperture of ½ m.m.

The simplicity of the apparatus will strongly recommend it to the attention of military engineers.

Electric Light.

The electric light, beyond doubt, surpasses all other lights in intensity, but also in costliness. On beacons, electricity as an illuminating power was first employed in 1857, when the Trinity House Corporation established the first electric light at South Foreland. In 1862, a second light was, by the same Corporation, established at Dungeness, which, in 1863, was followed by the lights established by the Compagnie d'Alliance, at Hâvre, at Odessa, and on board the yacht *Prince Napoléon*.

In nearly all the arrangements, the source of illumination is the beautiful arc of light (Faraday's arc) which stretches between the carbon-points placed at the poles.

As a constant transference of charcoal from one pole to the other is taking place, a change in the distance between the two carbons will be the consequence, without some arrangement by which they are kept at the distance which will secure the highest intensity, the proper colour, and the most perfect steadiness of the light.

On the want of steadiness, which results from the slightest change in the distance between the two carbons, has been heretofore based one of the main objections to applying electricity as an illuminating power. This difficulty has, however, been most successfully overcome by Messrs. Foucault and Duboscq's admirable regulator, and by the use of the carbons prepared by the Compagnie d'Alliance; and, accordingly, most of the recently constructed lighthouses are provided with electric light.

Moreover, it is evident that for military purposes such perfect steadiness and uniformity of light are not required, as are demanded in an apparatus for warning ships of danger, or in delicate optical experiments. An occasional flash is all that is needed for lighting channels and water-approaches. It would seem, therefore, that so delicate an apparatus as Messrs. Foucault and Dubosq's regulator is not absolutely necessary, and that the carbons prepared by the Compagnie d'Alliance and a simple micrometer-apparatus are amply sufficient.

For military purposes, that apparatus must be regarded as the most desirable which combines the greatest intensity in the current with the utmost compactness. Between acid batteries and magneto-electric machines, it is difficult to pronounce with decision. The Trinity House Corporation and the Compagnie d'Alliance have given the preference to the latter. The first cost-price of acid batteries may be less than that of the magneto-electric machine, but they require great attention to ensure safety and regularity, and the expense for keeping them in working order is considerable. Similar considerations, to which may be added the great compactness of the apparatus, would induce us to select these also for military purposes. Special attention is due to the inventions of Mr. W. Ladd, of London, and of Dr. Siemens, of Berlin.

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